LINAC & BTF

Luca Foggetta
on the behalf of LINAC and BTF teams

BTF ACTIVITIES

Since last SC and mid-term update (short summary)

- Be window failure in BTF1-BTF2 lines recovered in schedule – refurbishing complete
- BTF Line installation ongoing (BTFEH1 completed and tested) was on scheduled time, final part delayed due covid19
- BTF subsystems and services checked -> now switched off
- FLUKA Trials on Mylar damage simulation ongoing -> ANSYS to be setupped
- AIDA2020 e BL4S commitments
- BTF2 remastered layout and subsystem near to be completed
- BTF2 refurbishing in BTF Hall2 pratically completed
- From mid term meeting, SIDDHARTINO scheduled run end moved to April

UP to now, we foreseen

- Restart with long primary positron pulses for the **PADME run,** expected in first week of July (delayed from late April)
- **Final BTF 2 installation and commissioning expected in late Autumn (previously starting at September)**

LINAC ACTIVITIES

- **LINAC** operation and and faults
  - Good uptime from last SC, minor fault after GUN cathode replacement due to emitter depletion for the longer pulses
  - 96’ Klystron Mod. C substituted in Feb. due to cathode exhaustion.
  - after one month of good operations, occurred arcs and discharging -> loss of output power then substituting
  - During new Klystron conditioning, suspected vacuum fault on Elbow mod. C ionic pump
- **Consolidate the LINAC**: extend lifetime of 10 years
  - Implementing HVPS on 4 mod’s
    - **50% full operative**
  - Substituting mod’s and subsystem old electronics with a new embedded one
    - **Prototyping on Mod. B in debug**
  - Improved Maintenance and Diagnostics
    - **Improved MemCached based live DB**
    - **main software improvements and PFN simulation**
    - **Start studies with slow control energy feedback**

UP to now, we foreseen

Restart conditioning after LINAC tunnel installation for BTF in first of June

TIMELINE

Till Last Scientific commitee

08/04/2019: LINAC on for SIDDHARTA&BTFexp run

09/05/2019: Scientific Committee 57th

10/06/2019: First user in BTF-2 line beam setup

02/07/2019: Last user in BTF-2 line beam setup

07/07/2019: LINAC tuning for PADME run

08/07/2019: PADME test run start

25/07/2019: BTF change setup for PADME BKG study with BeW

-> Failure on BeWindow

08/2019 : Summer shutdown

~~**09->10/2019: Expected BTF2 installation**~~

~~**11->12/2019: Expected PADME RUN-phase 2 start**~~

09/2019: Definition and implementations of the relative safety procedures by RSPP and forming cleaning team

10/2019: start of very complicate cleaning trials

12/2019: Reopen BTF experimental area, then until 02/2019

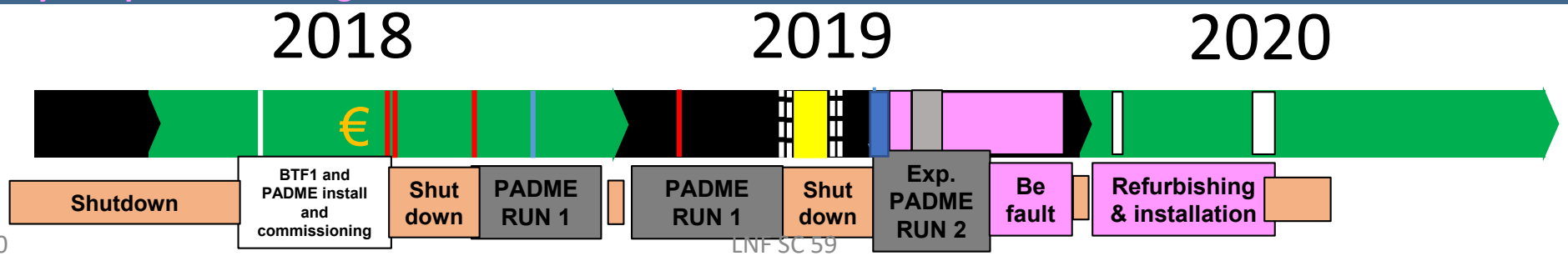
- Refurbishing for BTF1 and new vacuum safety system completed, BTF2 90% completed
- Alignment and vacuum installation and tests in BTFEH1/BTF1
- Setup preparation, mechanical and vacuum tests for Mylar window for vacuum breaking
- Fluka/ANSYS Simulation for Mylar window
- Final layout for new vacuum safety system LINAC/DR/BTF and PLC layout
- Preparation for LINAC area works for BTF line vacuum, cooling, vacuum safety system
- All of the BTF subsystems (diagnostic, detectors, network, high voltage) up and ready

30/01/2020 – LINAC Fault on Klystron Mod. C

- Trails, Substituition and Conditioning ended in one week -> restart

05/03/2020 – LINAC fault on already substituited Klystron Mod.C

12/03/2020 - Kly Conditioning suspended for COVID19



BTF SLIDES

BTF1 IN BTFEH1 PLANNING

Up to now, in BTFEH1:

- all the parts replacement orders have been executed; shipments ended
- PADME and magnets alignment in BTFEH1 done
- Mylar vacuum windows tests almost done
- BTFEH1 vacuum parts installed and tested
- Alignments done, magnets closed and ready.
- Magnet communication and low current test for BTFEH1 and part of BTF line in linac tunnel partially done. Remaining test stopped due to COVID19 (repeated after final installation in LINAC tunnel)
- BTF subsystems (diagnostic, detectors, network, high voltage) tested and ready -> now in shutdown

Task Name	Duration	Start	Finish
PH5 - BTF1 temp installation in BTFEH1	**15 days?**	**Tue 28/01/20**	**Mon 17/02/20**
vacuum installation and [illegible]	3 days?	Tue 28/01/20	Thu 30/01/20
manual valve installation	1 day?	Mon 17/02/20	Mon 17/02/20
magnets mechanical close align	2 days?	Wed 05/02/20	Thu 06/02/20
magnets service setup	1 day?	Fri 07/02/20	Fri 07/02/20
magnets test comm and power	1 day?	03/20 (delayed)	

Task Mode	Task Name	Finish
	SHIPPING	
✓	LINAC cooling tower valve	03/20
✓	vacuum parts	01/20
✓	manual valve shipping	02/20
✓	LINAC FAST VALVE shipping	02/20
✓	PADME cross adapter shipping	01/20

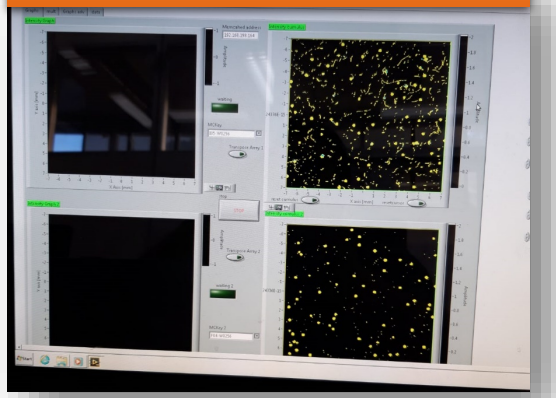
← BTF2 Line

← BTF1 Line

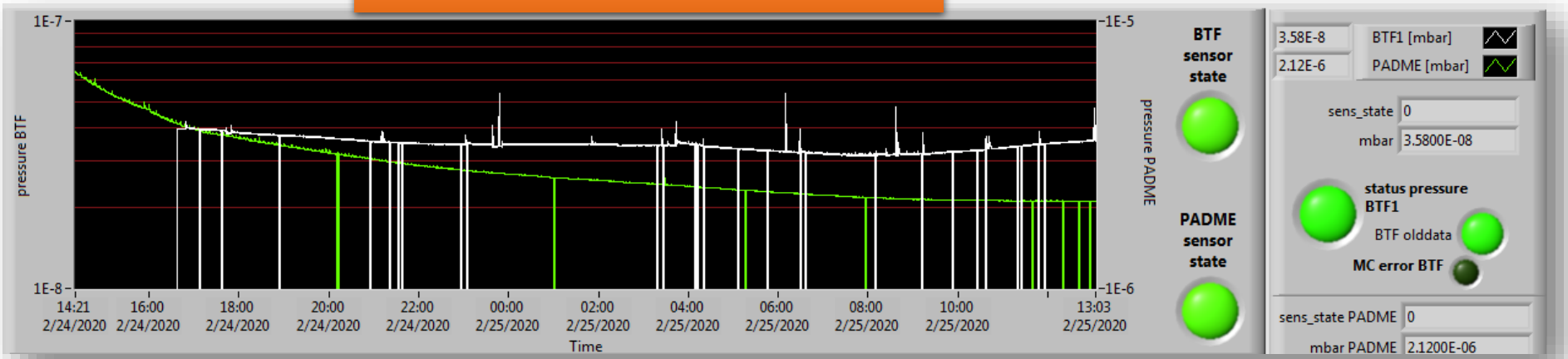
← Vacuum safety

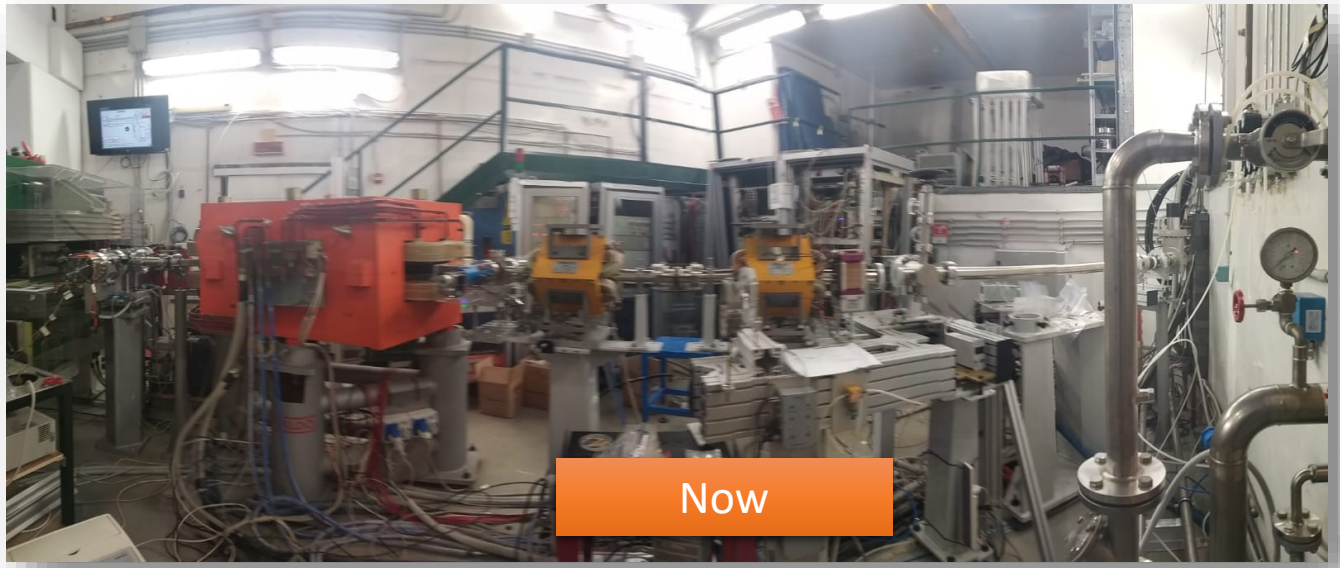
BTF status – BTF area tests

On 17/02 BTF exp. subsystem test



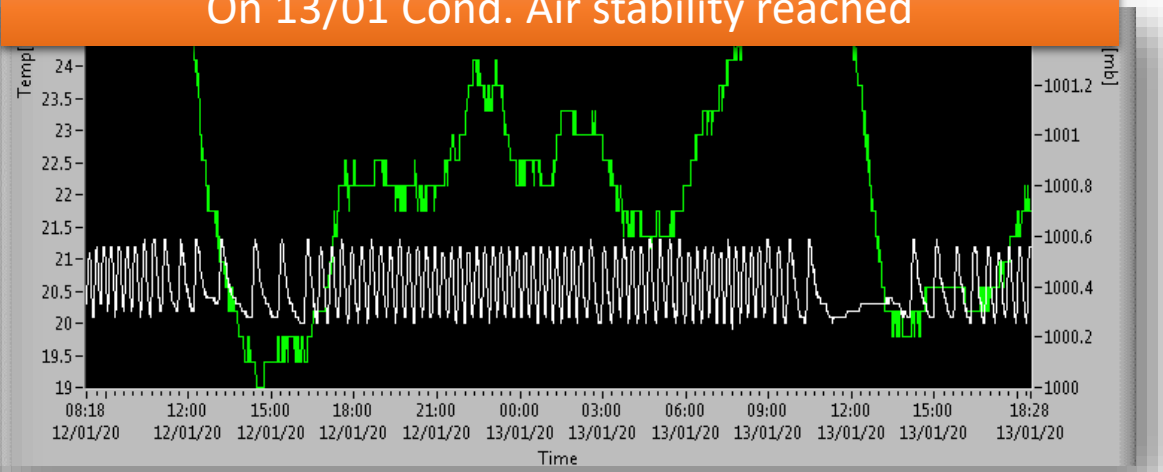
On 26/02 reached final vacuum



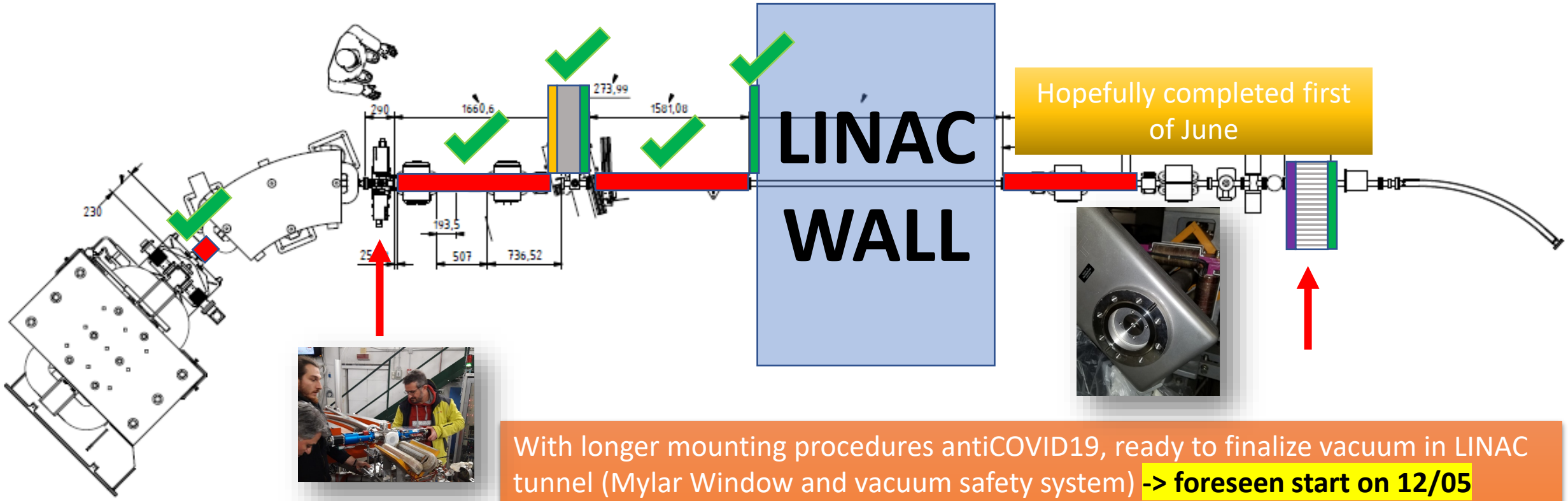


Now

On 13/01 Cond. Air stability reached



BTF1 LINE FOR PADME RUN



Vacuum Service (TMP, ~~Ionic~~)

Pipes

Vacuum Break (125um-mylar)

OPT. Secondary Vacuum Break (40um-mylar)

Manual Valves

With longer mounting procedures antiCOVID19, ready to finalize vacuum in LINAC tunnel (Mylar Window and vacuum safety system) **-> foreseen start on 12/05**

Line and area new specs:

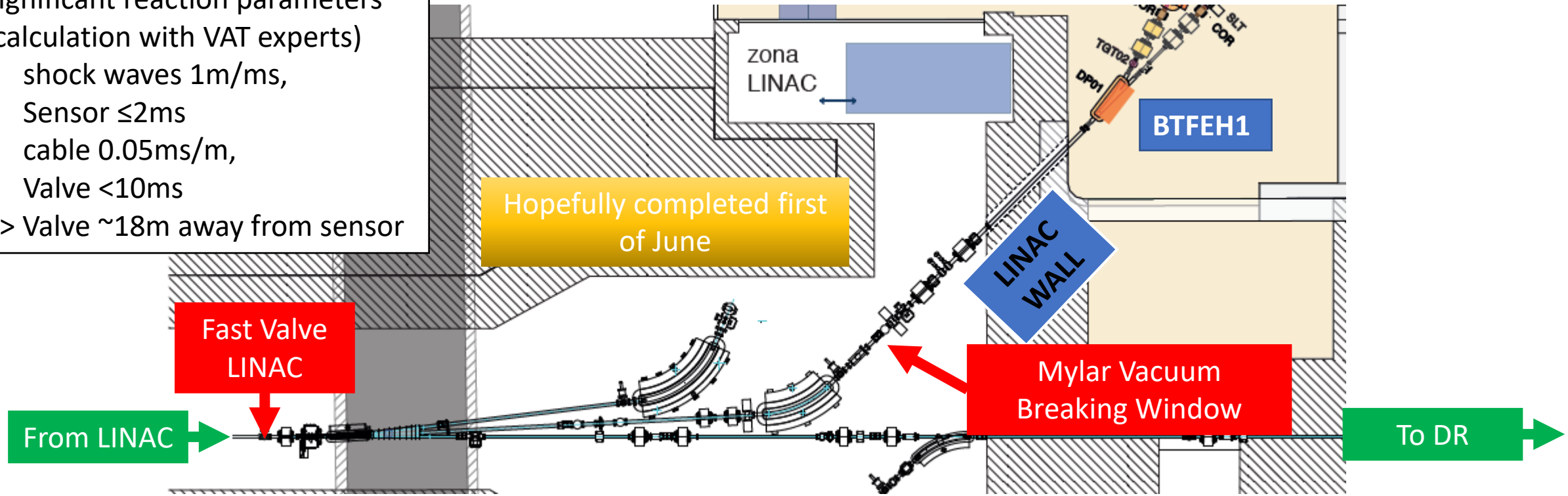
- Easy installation for PADME run – Removal of DP01 away but in situ joints for easy BTF2 installation (just replacing DP01), Straight CF63
- New main door for BTFEH1, interlocks installation done
- BTFEH1 Line alignments done. Magnets closed, power test at the end of LINAC works

BTF VACUUM SAFETY SYSTEM

Significant reaction parameters (calculation with VAT experts)

- shock waves 1m/ms,
- Sensor ≤2ms
- cable 0.05ms/m,
- Valve <10ms

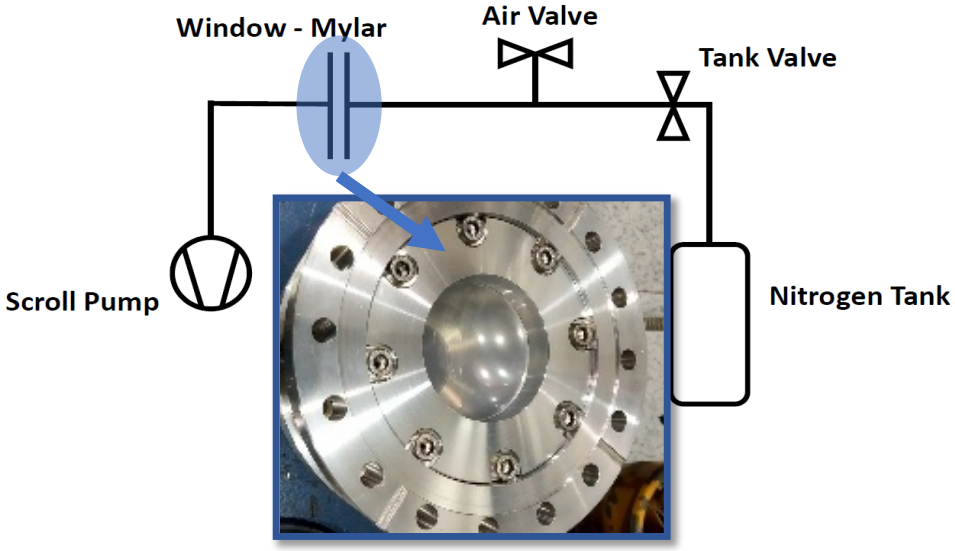
=> Valve ~18m away from sensor



Mylar Window specs:

- Permits vacuum types separation from PADME (TMP) to BTF/LINAC vacuum pipes (ionic)
- Implies a low leak, fast valve upstream in LINAC – ACC area, new vacuum safety system
- Fast Valves, Mylar window and holder and related pipes are ready to be installed
- PLC vacuum intelocks logic ready to be implemented

MYLAR WINDOW STATUS

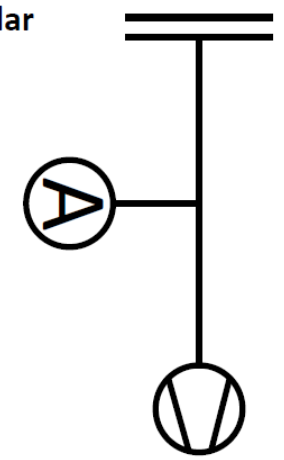


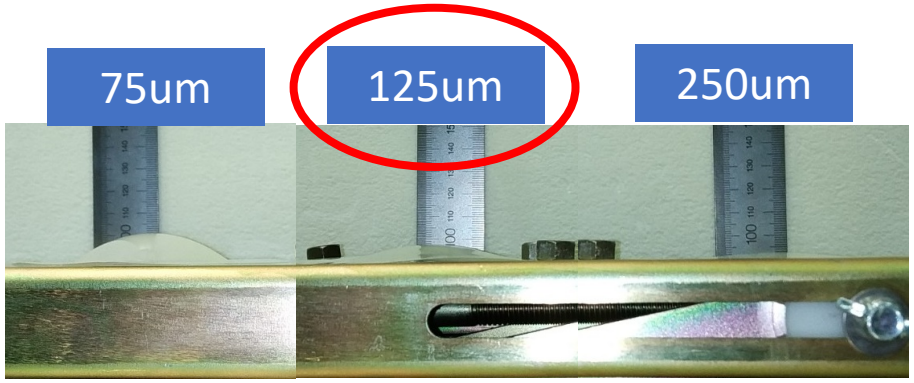
Tested Windows
- 75 µm
- 125 µm
- 250 µm

Tested Overpressure
Up to ΔP=4 bar

Test Conditions
At least 5 cycles of abrupt ΔP=1 bar -> ΔP=4 bar by nitrogen input

Test Results
- No Window break
- Final deformation at center
  - 75 µm -> 18mm
  - 125 µm -> 8 mm
  - 250 µm -> 4.5 mm





From the point of view of mechanical and vacuum performances, Mylar windows 125µm demonstrate reliability and maintenance feasibility (Indication of last update SC)

Courtesy of our Vacuum service (Alesini, Lollo, Liedl and all)

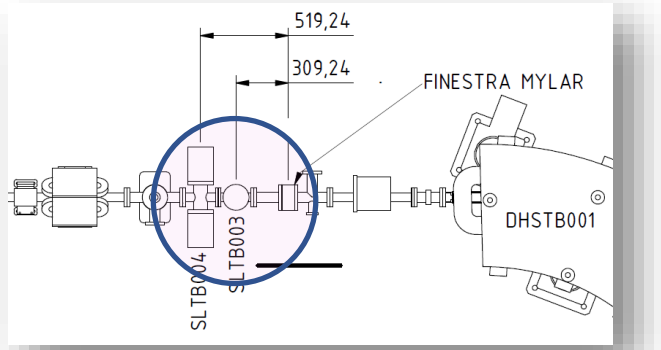
MYLAR WINDOW AGING

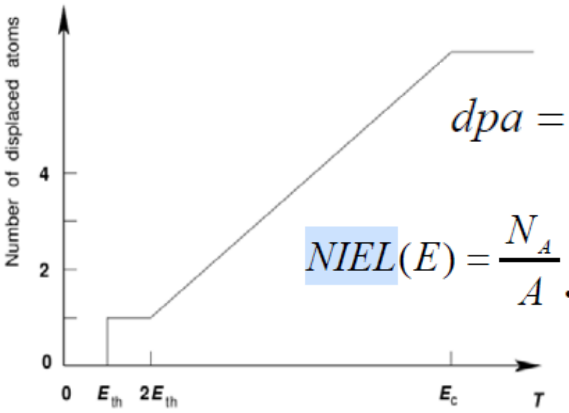
Trials to simulate window aging (Indication of last update SC):

- Positron Beam as direct interactions
- Scraper generated neutrons, heavy particles and electromagnetic showers (e,p photons) in secondary interactions

FLUKA based simulation activated cards in our mylar window mesh of DV = 2mm^3 , needed for homogeneous data. Some of the scoring will be:

- Displacement Per Atom (*DPA)* -> DPA-SCO *fraction of displacement in units of structural lattice, atoms (based on Frankel pairs – interstizial near vacancy*)
- Non-ionizing energy loss (NIEL) -> RES-NIEL *Restricted above damage threshold NIEL, mostly recoiled atoms, up to* T_{max}
- Energy released
- Neutron balance -> NEU-BALA neutron differential flux all the interaction
- Active dosimetry for experimental model validation



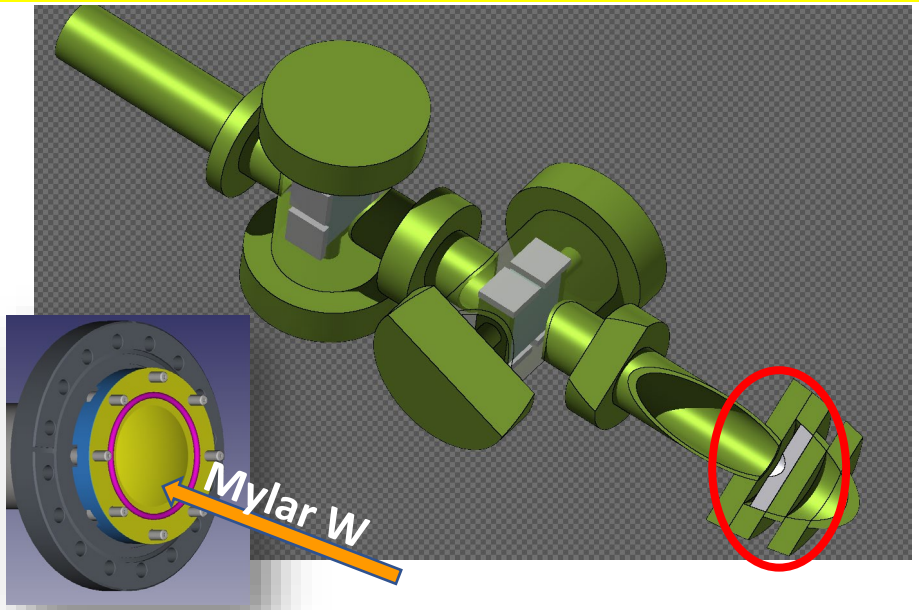


$$dpa = \frac{A}{N_A \rho} N_F$$

$$NIEL(E) = \frac{N_A}{A} \int_0^{\gamma E} \xi(T) T \left(\frac{d\sigma}{dT} \right)_E dT$$

N_F =*Frankel pairs* - Norgert, Robinson and Torrens (NRT) model

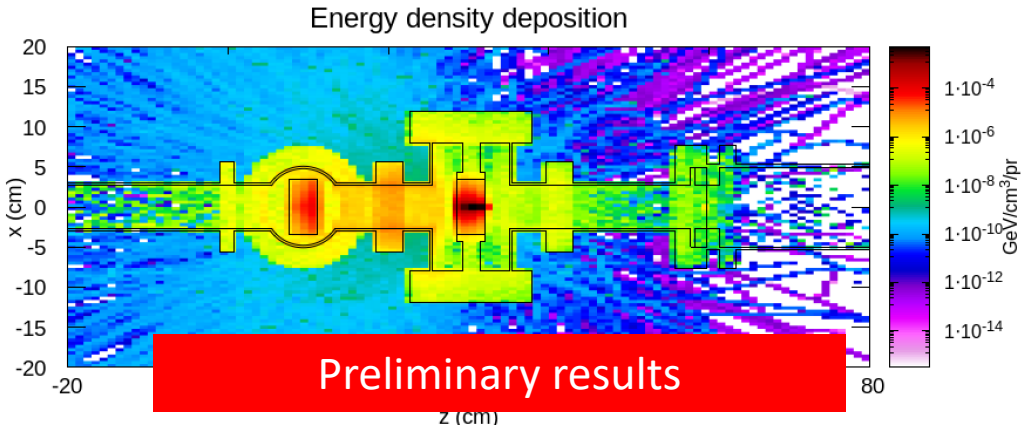
Collaboration with Lina Quintieri ISIS UKRI – STFC Oxford

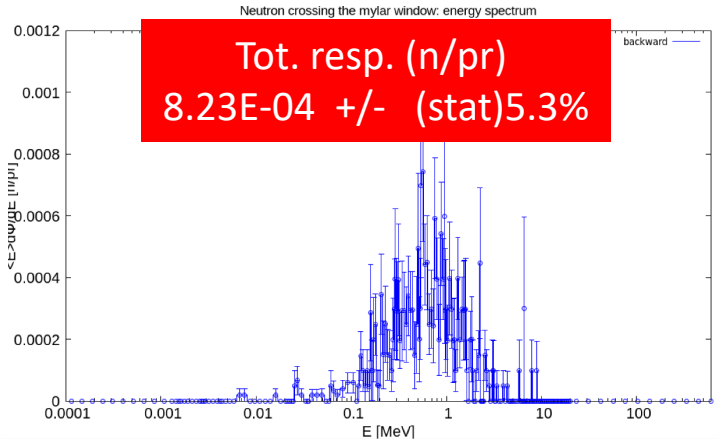


MYLAR WINDOW SIMULATION

FLUKA – Bad Irrad profile

- E= 500±3%MeV
- sx=sy=2mm, gaussian
- Charge pulse =10E9 positrons,
- uniformly distruited
- ΔT(pulse)=250E-9 s
- Pulse rep= 2E-2 s
- Irrad time= 5.2E6 s (2 monthsDC=100%)
- Int. positrons = 2.6E18
- DPA thr (Mylar) assumed equal to Al (27e

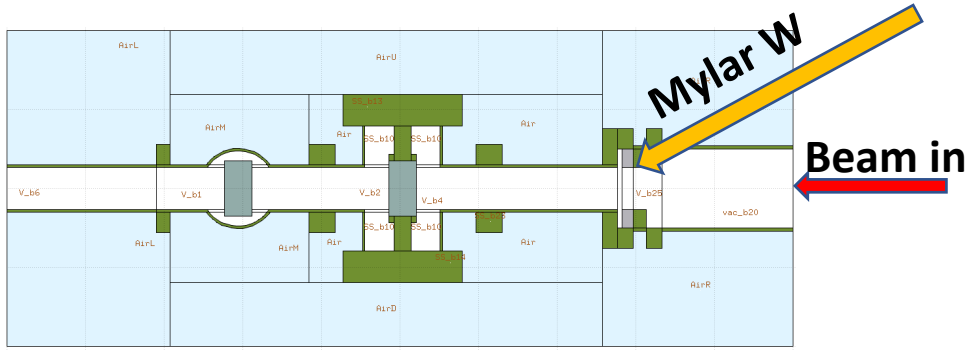




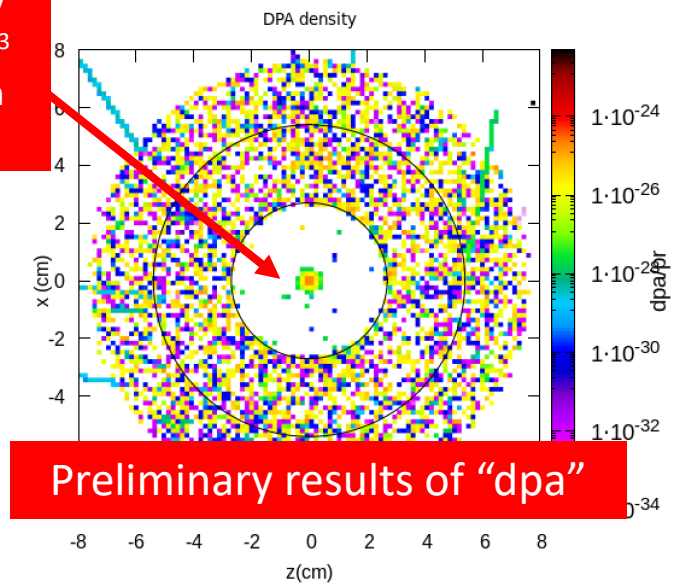
FLUKA results:

- Show to be robust in respect to the physics implemented
- Neutron yield in agreement semiempirical calculations (Swanson, SLAC)
- Gives a dpa estimation in Mylar, not so easy

- Further analisys (improving mesh) will give better energy deposition profile in mylar in order to evaluating structural response in Mylar,
- ANSYS for transient (pulsed thermal load)



Preliminary average 10^{-3} dpa/year in this area



BTF1 PLANNING - 1

Expected activities (mostly on the run):

- LINAC Cooling tower & pipes workout, fixing duct routing
- End of alignment campaign on LINAC tunnel
- BTF line in LINAC tunnel workouts then BTF1 ready
- Vacuum safety system preparation, all parts arrived
- PLC setup for Vacuum safety system and BTF2 installation
- LINAC ionic pump repair and conditioning

Anti COVID-19 procedures expected delays:

- Start ops moved from 14° April to May
- Restriction on area occupancy and distance between workers (Work time increase and additional time in project/ordering new system for the new procedure easiness)
- External firms and third parties delays for getting needed anticovid bureaucracy, commissioning and interventions

Task Name	Duration	Start	Finish	% Complete
PHASE 5 - BTF1 temp commissioning	**232 days?**	**Mon 07/10/19**	**Tue 25/08/20**	**78%**
covid19	2,1 mons	Fri 21/02/20	Mon 20/04/20	0%
SHIPPING	**55 days**	**Mon 16/12/19**	**Fri 28/02/20**	**100%**
Cooling	**104 days?**	**Mon 16/12/19**	**Thu 07/05/20**	**86%**
Alignments BTFEH1	**4 days?**	**Tue 21/01/20**	**Fri 24/01/20**	**100%**
SAFETY	**95 days?**	**Mon 07/10/19**	**Fri 14/02/20**	**100%**
PH5 - BTF1 temp installation in BTFEH1	**25 days?**	**Tue 28/01/20**	**Mon 02/03/20**	**87%**
LINAC Klystron C – setup	**16 days**	**Wed 22/04/20**	**Tue 12/05/20**	**100%**
LINAC Klystron C – restart conditioning	**2 wks**	**Tue 09/06/20**	**Mon 22/06/20**	**50%**
Ph5 - BTF1&LINAC installation "settimana famosa	**28 days?**	**Mon 04/05/20**	**Wed 10/06/20**	**6%**
LINAC "week" start	0 days	Mon 11/05/20	Mon 11/05/20	0%
Alignment campaign for BTF in LINAC tunnel	1 day?	Mon 11/05/20	Mon 11/05/20	0%
LINAC cooling externals document preparation	3 days	Mon 04/05/20	Wed 06/05/20	100%
Linac cooling sala pompe	1 wk	Thu 14/05/20	Wed 20/05/20	0%
LINAC cooling emptying&work tower	2 wks	Thu 21/05/20	Wed 03/06/20	0%
PLC LINAC BTFEH1 setup	1 wk	Thu 04/06/20	Wed 10/06/20	0%
BTF installation in LINAC tunnel	**19 days?**	**Mon 11/05/20**	**Thu 04/06/20**	**0%**
vacuum installation	12 days	Tue 12/05/20	Wed 27/05/20	0%
magnets mechanical closing	2 days	Thu 28/05/20	Fri 29/05/20	0%
magnets service setup	1 day?	Thu 28/05/20	Thu 28/05/20	0%
BTF magnets test	**2 days?**	**Fri 29/05/20**	**Mon 01/06/20**	**0%**
Ph5 - new vacuum safety system	**19 days?**	**Mon 11/05/20**	**Thu 04/06/20**	**0%**

BTF1 PLANNING - 2

Expected activities (mostly on the run):

- **BTFEH1 diagnostic and scientific services preparation**
- **LINAC tune up for PADME beam**
- **PADME run -> 2 months (summer stop TBC)**

Dubts, difficult to answer now:

- Summertime BTF run never been tried (max the first week of August). BTF reliable conditioned air with anticovid rules may be tested on June/July
- The same on LINAC modulator hall. Now we schedule to improve LINAC modulator hall conditioned system.
- Personnel and shifter vacation
- Water provisioning for LINAC/BTF in the past was not a problem.

Task Name	Duration	Start	Finish	% Complete
LINE TEST	**109 days?**	**Sat 01/02/20**	**Thu 02/07/20**	**36%**
PADME ready		May TBD	Wed 17/06/20	See Raggi presentation
BTFEH1&PADME vacuum test	2 days	Wed 19/02/20	Thu 20/02/20	100%
BTF line in LINAC tunnel test	1 day?	Fri 05/06/20	Fri 05/06/20	0%
Vacuum safety system test	2 days	Thu 11/06/20	Fri 12/06/20	0%
BTF line & PADME vacuum test	3 days	Thu 11/06/20	Mon 15/06/20	0%
scraper test	16 days	Sat 01/02/20	Mon 24/02/20	100%
redo scraper test	1 day?	Fri 05/06/20	Fri 05/06/20	0%
BTF diagnostic and subsystem setup	1 wk?	Sat 01/02/20	Fri 07/02/20	100%
redo BTF diagnostic and subsystem setup	1 wk	Fri 29/05/20	Thu 04/06/20	0%
DAFNE safety test	1 day	Thu 25/06/20	Thu 25/06/20	0%
BEAM setup	5 days	Fri 26/06/20	Thu 02/07/20	0%
PADME run start	2 mons +	Fri 03/07/20	Up to Oct	0%

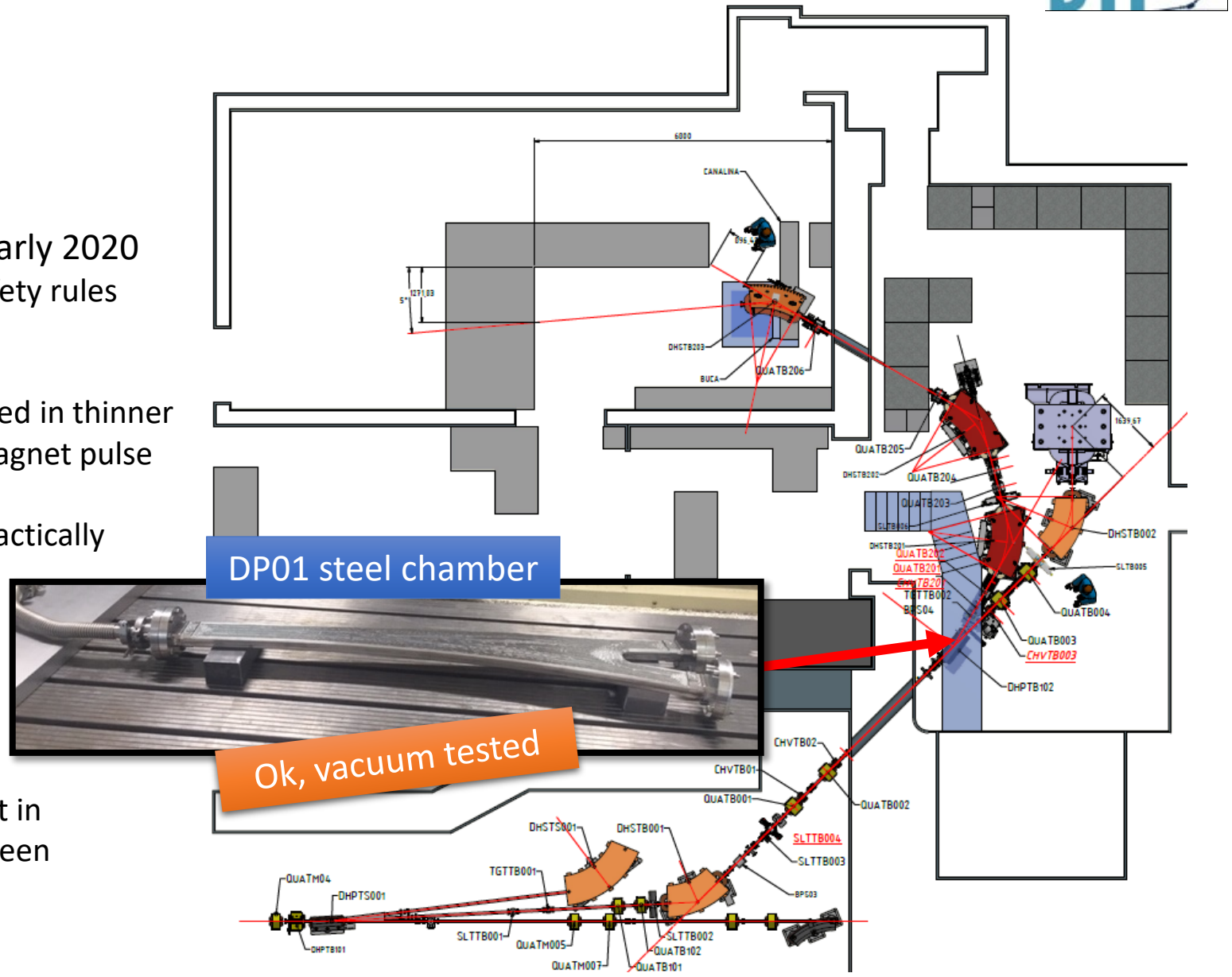
BTF UPGRADE SLIDES

VACUUM

Delays due to COVID19 but we push forward:

- Final Project BTF2-BTFEH2 line achieved in early 2020
  - Refactor of beamline final parts to match safety rules clearence exit DC01
  - Added shielding and REI finishing
  - Refurbished DP01 vacuum chamber refactored in thinner wall to resolve some vibrational issues on magnet pulse (BTF split part)
  - Final project of supports, girder and tools practically completed in this week

- Final project elements orders:
  - DP01 vacuum chamber ready for shipping
  - All of the remaining ordered (exceptions what in final project at the end of may, shipping foreseen before autumn)



MAGNETS

DC01:

- assembled,
- FAT this week
- Shipping possible
- Then PS test

DH:

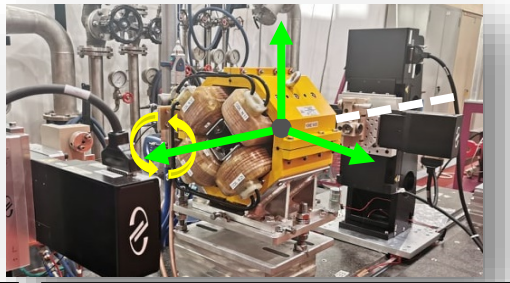
- Seems ok

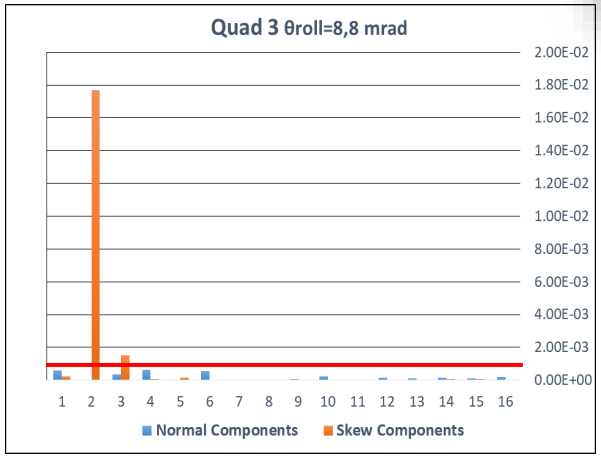
DP:

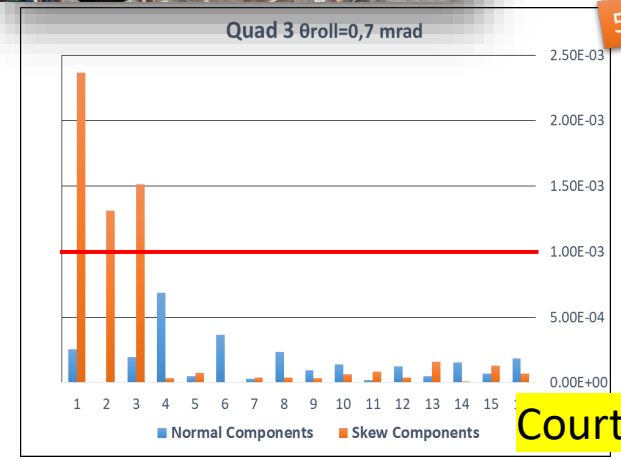
- Already mounted

QUAD:

- PS full power tests at 50%
- Integrated Gradient ok
- high skew component
- adjustable on roll tilt
- TBC in the next weeks







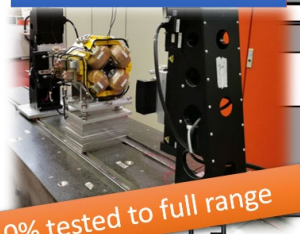
1x DC

FAT test and shipping

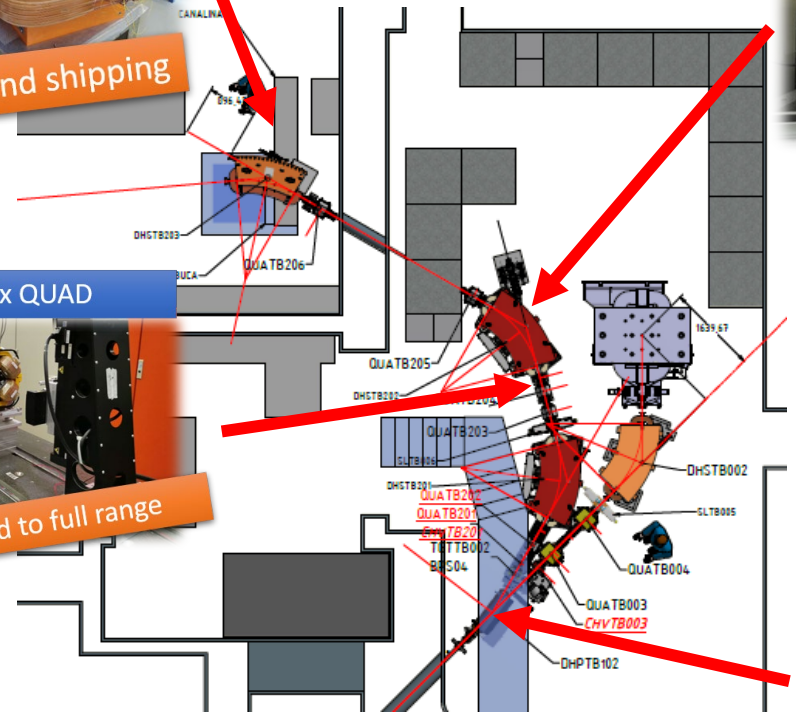
2x DH

OK – ready tbm

6x QUAD



50% tested to full range



2x Correctors ok

1x DP

OK – al-ready tbm

Courtesy of A. Vannozzi, LNF 2020

NEW POWER SUPPLY HALL

- New room for hosting the power supplies for the 10 new magnets
- Needs reinforcement of the floor due to full racks weight
- All cables (interlocks-mains-power) routed and installed



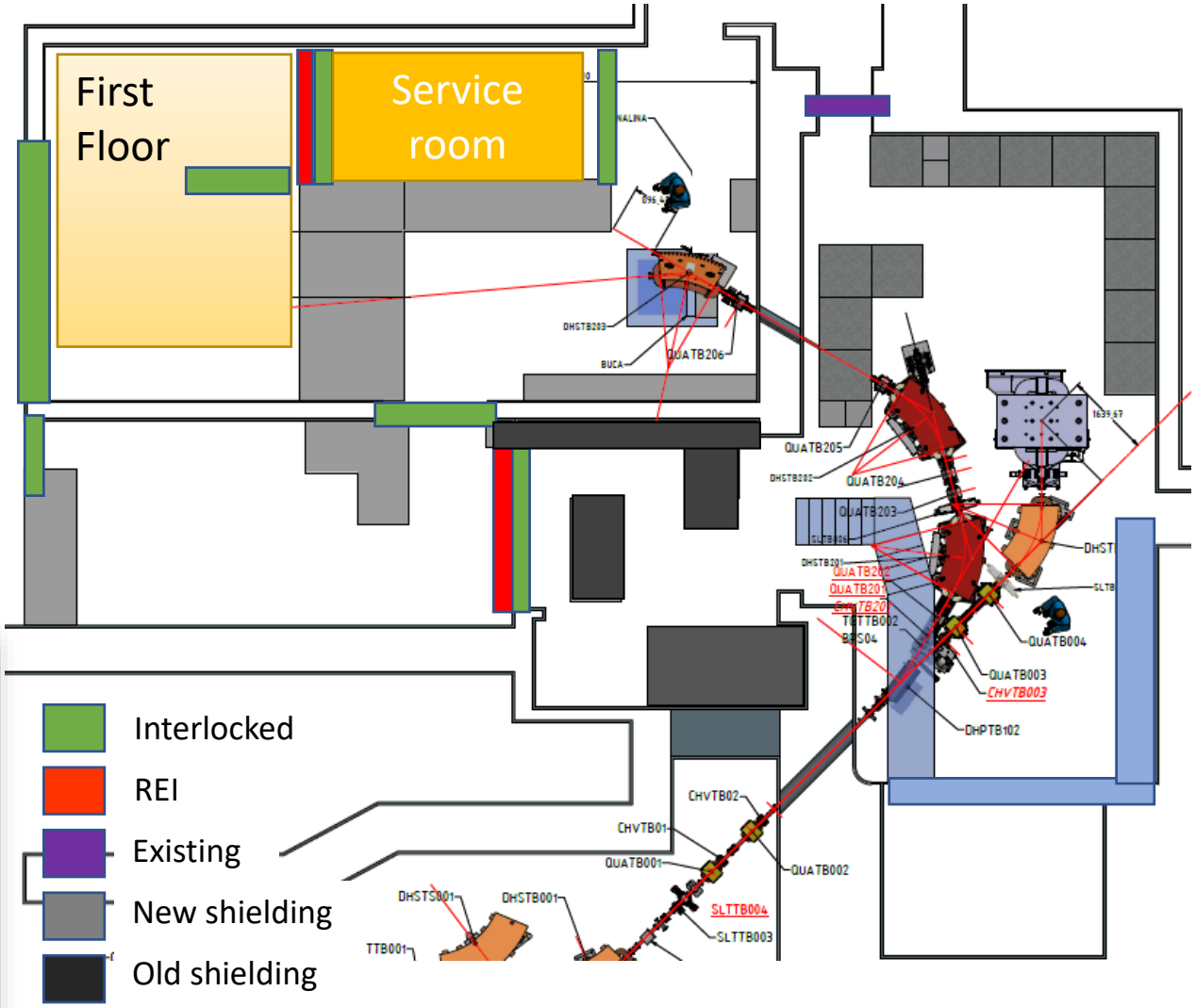



- Networking settled up, final position test communications done, DCS test ongoing
- QUAD-DP-DH PS are fully tested with magnets (DC01 waiting shipment)
- DC01 PS no needs firmware upgrade
- BTF2 Safety system rack and electronics installed
- Cooling and Air conditioning seems ok

SAFETY

- Final design and orders accomplished for the interlocked and REI gate/doors
- BTFEH1 main entrance gate upgraded
- Safety system installation pushed up to 90% for BTFEH2 and PS Hall
- Safety upgrade staircase for matching safety search in BTFEH1 final design, in production
- Safety rules defined, few optimizations



FLUIDS

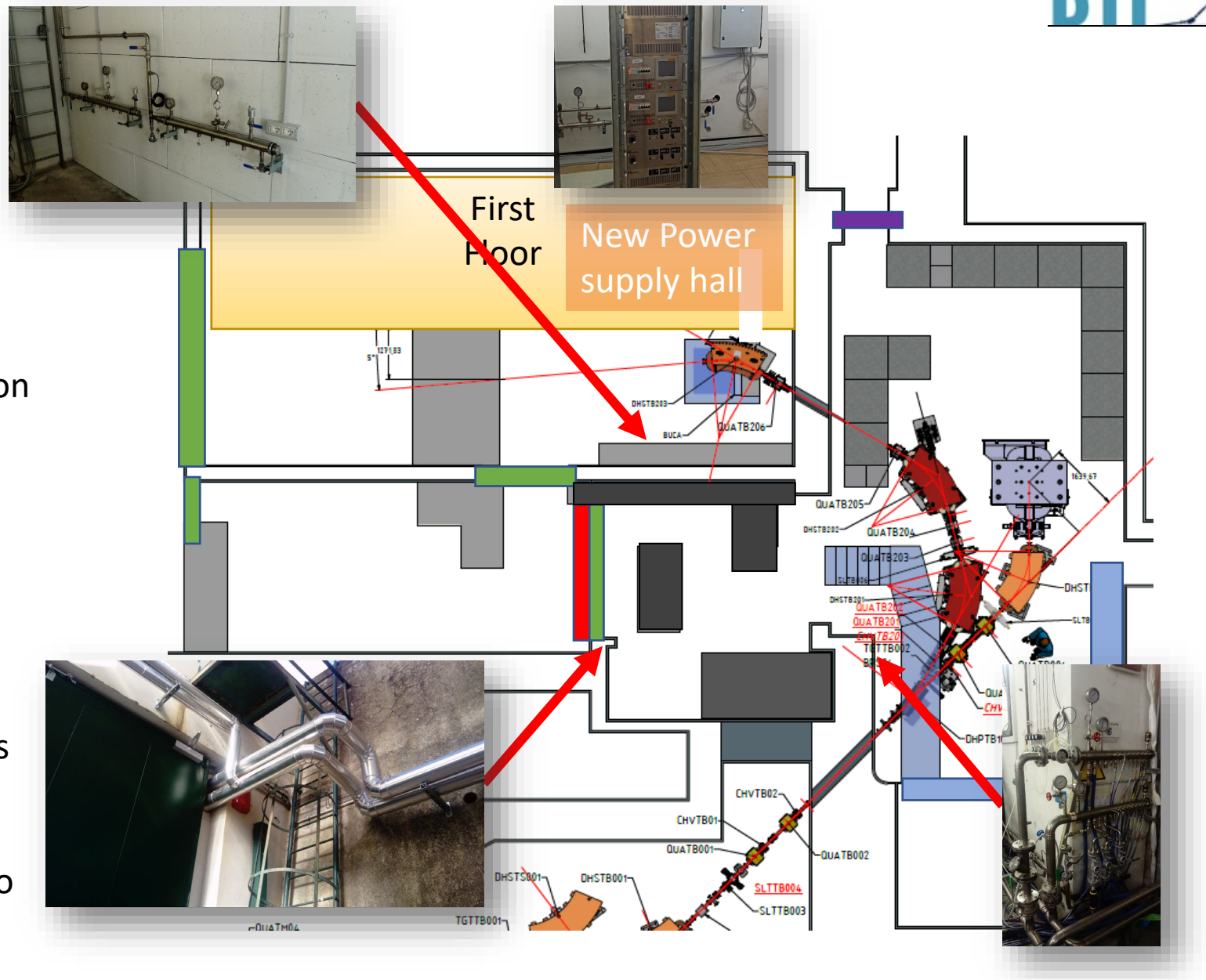
- 90% of cooling upgrade fixed
  - New Supply hall connected and air conditioned
  - BTFEH1 connected and tested
  - BTFEH2 connected and tested

- BTFEH2 air compressed line in final installation (end of may)

- LINAC evaporation tower (main workout, dismantle of previous duct setup and circuit emptying) scheduled on next week, three weeks

- New PLC firmware for BTF2 cooling interlocks at the end of the installation, test follows

- Some minor works regarding modifications to pipes routing



BTF2 ACTUAL PLANNING

Strongly in dependence of the next month, but up to now:

- BTF2 installation will start at the end of PADME run, probably after the SIDDHARTINO re-start (mostly for people involved) -> end of October
- After BTF2 installation, will start the commissioning and it could be very long (maybe two/three months) -> BTF2 beam not before December
- After BTF2 commissioning will start the user campaign, hoping in the first months of 2021

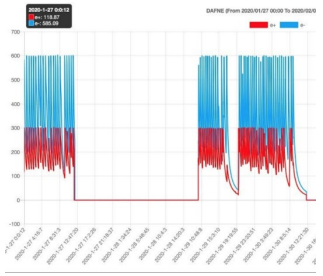
LINAC SLIDES

shortly

LINAC ACTIVITIES

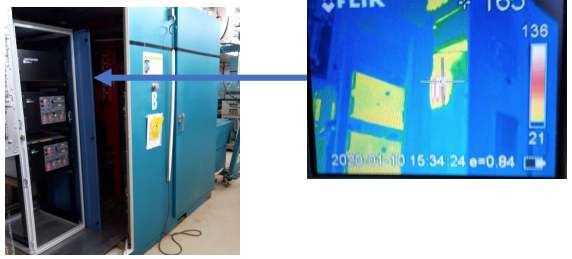
Linac last uptime

- For DAFNE from up to 20 December 2019
- for DAFNE from 10 January up to 30 Jan



Linac Maintenance:

- Water cooling maintenance (7 Jan)
- Check modulators mechanics

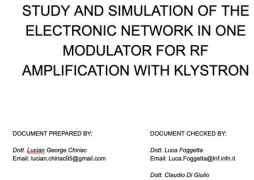


Linac Consolidation

- Deeply Check and improve temperature drift in modulator B for solid state HVPS
- Software development for history of LINAC status dataset
- 28 29-11-2020: RF Phase stability measurements with RF group
- Implemented MemCached based live DB for LINAC parameter
- Studies for trials with slow control energy feedback

Linac Upgrade

- Simulation for PFN of new modulator
- New Modulator Electric distribution ready
- New modulator Coil ready (Dic. 2019)


STUDY AND SIMULATION OF THE ELECTRONIC NETWORK IN ONE MODULATOR FOR RF AMPLIFICATION WITH KLYSTRON

DOCUMENT PREPARED BY:

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Dott. Claudio Di Giulio

SPARC-Lab:

More support on modulator and klystron&safety system.
 - 29 January SPARC Bias supply fault, Scandinova contacted for spare parts, then investigating the fault. Fixed after 1 week.

Safety system:

DAFNE Linac Access control system fault and Accumulator access gate.

DAFNE:

Installation of gamma monitor for detecting collider collisions on 11-12/12/2020

LINAC STATUS

- Good uptime from last SC, minor fault after GUN cathode replacement due to emitter depletion for the longer pulses
- Move further for upgrade on Mod-D, in its final setup

- Major fault on Mod-C on 30-Jan
  - trials to recover Mod-C Klystron after fault due to bad kly pulse (also overhauling of the most important tank elements) but after one day = short circuited filament
  - '96 Klystron: after one filament replacing before 2011 refiring, Filament hot = 66k hours, HV on cathode = 45K hours, both active measurements, in few day we start conditioning
  - In the mean time we have prepared (tank empty…) Mod-C for solid state HVPS installation (mainly transformer substitution and PFN tuning)

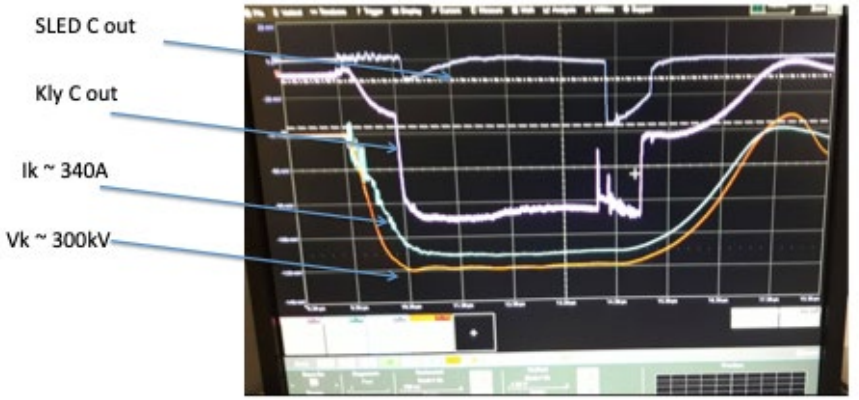
06/02/2020 Ready for operation at 25 Hz

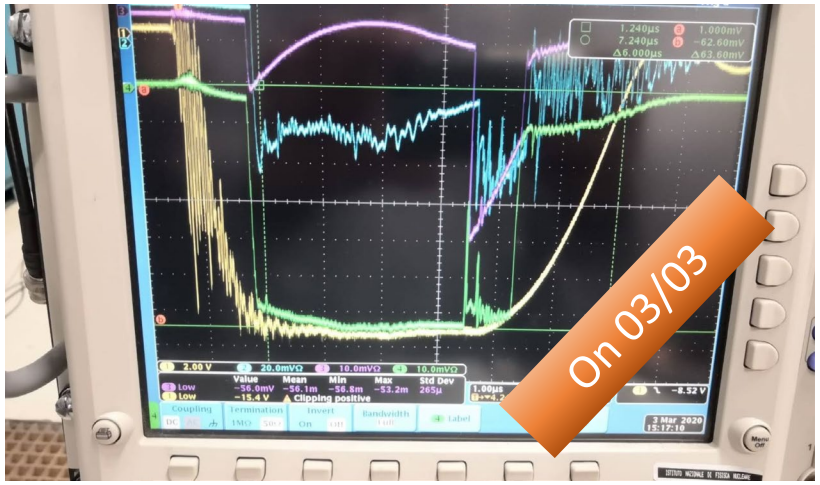
Not stable operation – arc located upper in the tube but seems not from OUT window

04/03/2020 - change Klystron, during vacuum found RF guide elbow pump performances -> changed this week

12/03/2020 – 50% Kly Conditioning suspended for COVID19

Conditioning 25Hz and 50Hz up to 05 Feb 2020





LINAC KLY C COND & TOOLS

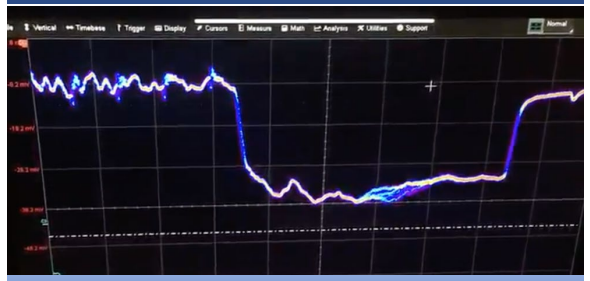
Istituto Nazionale di Fisica Nucleare
Laboratori Nazionali di Frascati

BTF

A lot of activities, some upgrade example:

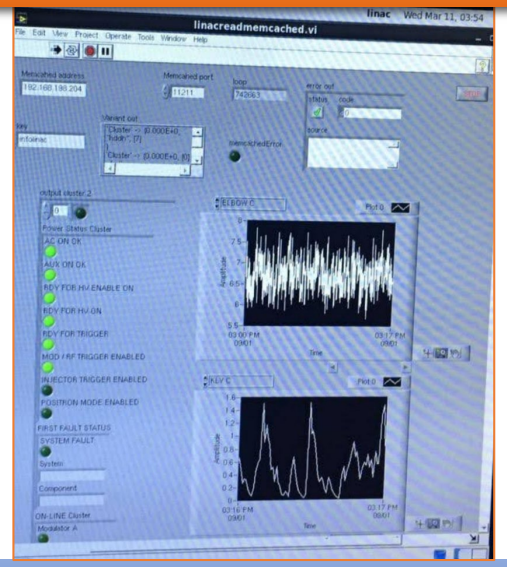
Kly change status

Starting from 05/03/2020. Kly as diode ok in 1 day.
Start RF conditioning, short pulse.(07/03/2020)



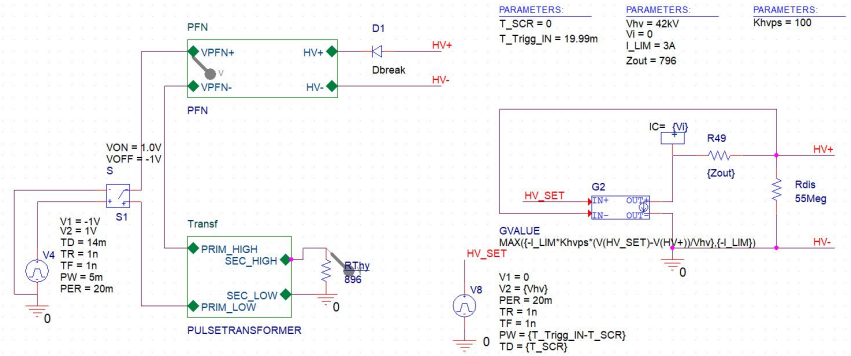
Noise in RF kly forward with longer pulse (09/03/2020 until 11/03/2020)

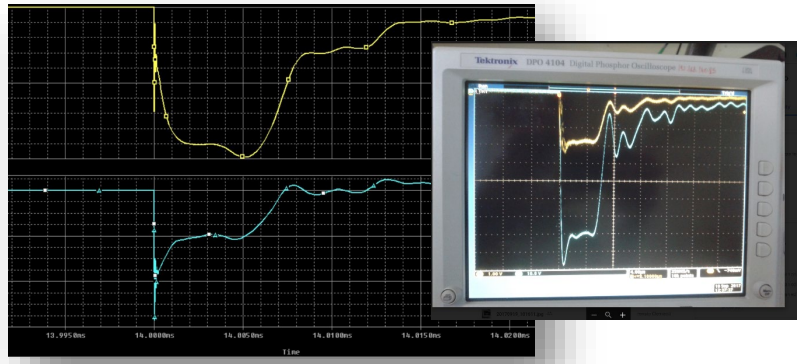
New Tools Live DB



Implemented in the main software a MemCACHED based live DB for getting all the LINAC parameters in a new diagnostics software at UI

New Tools Mod simulation





PSPICE simulation (Lucian Chiriac, Gr. Stud.) including real calculation beyond lumped element model: Thyratron, HVPS and real transformer

Courtesy of L. Chiriac, LNF 2020

LINAC FAULTS

LIST:

2020-02-25 **FAULT LINAC MODULATOR C** Arc and discharge Mod. C
After 4 days a water leak in the Linac tunnel water load circuit fixed.

2020-02-16 **FAULT FLUIDS COOLING WATER FLOW FAILURE LINAC**UFS 578 'low water flow'

Fixed power supply control chassi mod B and with ELBOW vacuum pump power supply changed.
2020-02-14 **FAULT LINAC MODULATOR B** Klystron arc detector sul modulatore B

Changed klystron
2020-01-30 **FAULT LINAC MODULATOR C** Klystron filament

2020-01-21 **FAULT LINAC MODULATOR C** High voltage 3phase circuit fuse changed

Fixed (Conditioning)
2019-01-20 **FAULT LINAC MODULATOR A** Different clipper current and pulse current
Fixed with timing integrate circuit tuning

2019-01-19 **FAULT LINAC MODULATOR D** Reset power supply

2019-12-20 **FAULT LINAC MODULATOR D** Charging resistor firing. We decide to install the NEW power supply in the MOD D. Ready for operation 08/01/2020

2019-12-16 **FAULT LINAC MODULATOR C** Despiking coil on fire. Changed with old part of mod D.

2019-11-26 **FAULT LINAC MAGNET WATER COOLING** qw 10: brazing

2019-11-11 **FAULT LINAC MAGNET POWER SUPPLY** QW 30 31 (MPS 45) fixed 13-11

LINAC PLANNING

Task Name	Duration	Start	Finish	% Complete
LINAC	**46 days?**	**Wed 22/04/20**	**Wed 24/06/20**	**37%**
production of new tools for installing pump in elbow mod. C	1,4 wks	Wed 22/04/20	Thu 30/04/20	100%
change pump elbow modC	2 days	Mon 04/05/20	Tue 05/05/20	100%
elbow ModC vacuum	2 days	Wed 06/05/20	Thu 07/05/20	50%
air cooler modulator hall maintenance	1 wk	Wed 06/05/20	Tue 12/05/20	0%
new air cooler in modulator hall		Mon 04/05/20	June 2020	25%
UFS order	6 days?	Wed 29/04/20	Wed 06/05/20	100%
~~UFS installation (postponed)~~	~~2 wks~~	~~Thu 07/05/20~~	~~Wed 20/05/20~~	~~0%~~
LINAC conditioning	2 wks	Thu 11/06/20	Wed 24/06/20	0%

PEOPLE

BTF group

Bruno Buonomo+, Claudio Di Giulio, Luca Foggetta,

Gianfranco Morello

+BTF technical manager and LINAC head

LINAC staff

Maurizio Belli*, Riccardo Ceccarelli, Alberto Cecchinelli , Renato Clementi*, **Lucian Chiriac**^,

Graziano Piermarini, Luis Antonio Rossi, Serena Strabioli, Raffaele Zarlenga

* Retired, ^end empl

Technical and Accelerator Divisions services

Sergio Cantarella, Oreste Cerafogli*, Paolo Ciuffetti, Enrico Di Pasquale, Alessandro Drago*, Adolfo Esposito, Francesco Galletti, Andrea Ghigo, Simona Incremona, Franco Iungo, Stefano Lauciani, Roberto Mascio, Stefano Martelli, Marco Paris, Stefano Pioli, Luigi Pellegrino, Francesco Putino, Ruggero Ricci, Ugo Rotundo, Lucia Sabbatini, Franco Sardone, Giancarlo Sensolini, Alessandro Stecchi, Angelo Stella, Alessandro Vannozzi & DAFNE operators for runs

* Retired, ^end empl

CONCLUSIONS

- Be window failure in BTF1-BTF2 lines recovered in schedule – refurbishing complete
- BTF Line installation was on scheduled time, final part delayed due covid19 in May
- BTFEH1 completed and tested, BTF subsystems and services checked
- FLUKA Trials on Mylar damage simulation ongoing
- BTF2 remastered layout and subsystem near to be completed
- BTF2 refurbishing in BTF Hall2 practically completed
- BTF2 installation will start at the end of PADME run (two months), probably after the SIDDHARTINO re-start (mostly for people involved) -> not before end of October
- After BTF2 installation, will start the commissioning and it could be very long (maybe two/three months)

-> BTF2 beam not before December

- After BTF2 commissioning will be start the user campaign, hoping in the first months of 2021
- LINAC ready to complete conditioning (vacuum on RF elbow Mod. C restoring)

CONCLUSIONS

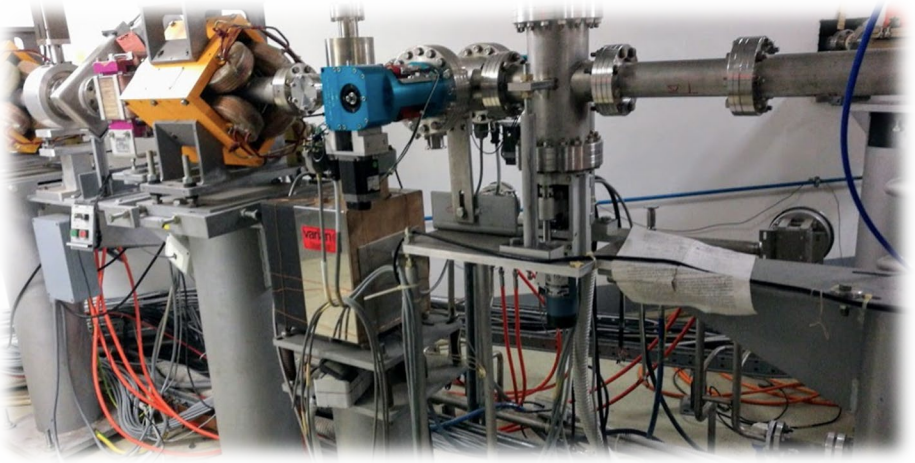
THANKS

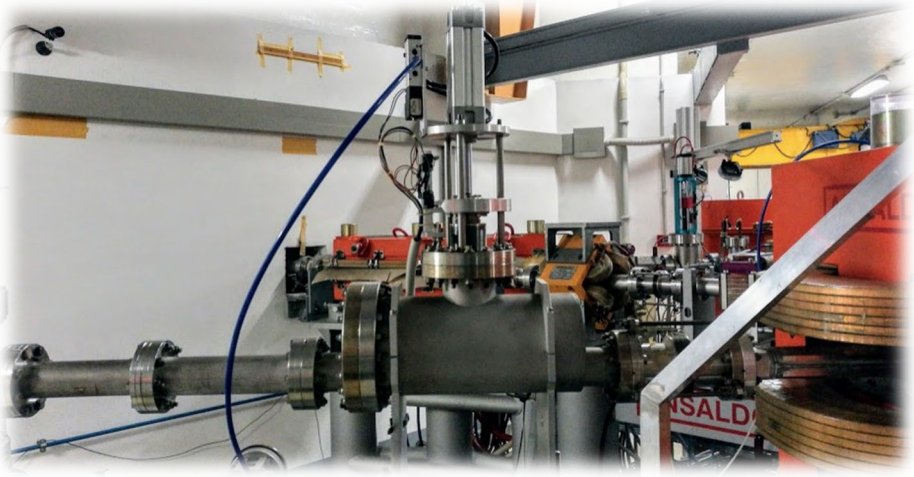
SPARE SLIDE

NEW VACUUM LAYOUT

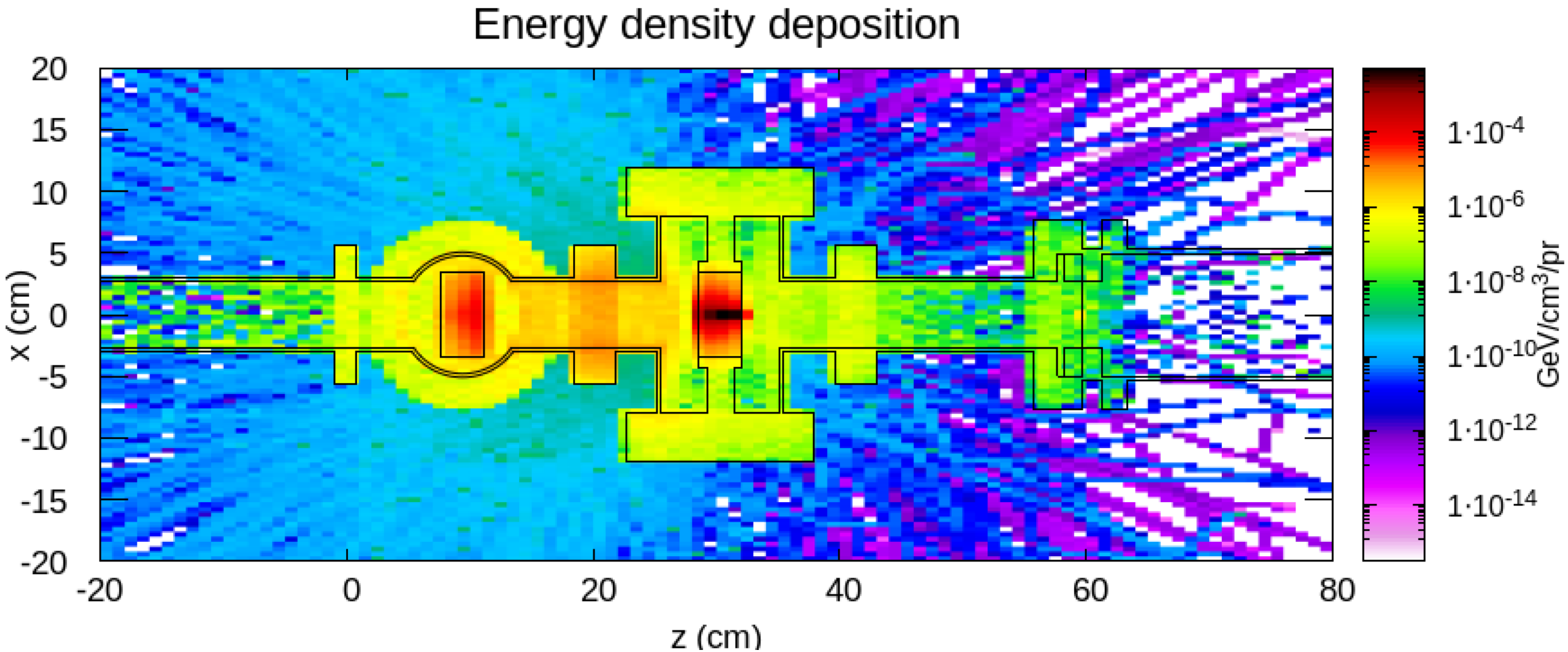
New (and old) Constraints

- Using a different material (e.g. Mylar) is a valid candidate $X_0(Be)=0.8X_0(Mylar)$
- Using more than one, but thinner window, would give additional safety margin with the some total thickness crossed by the beam
- Vacuum separation between PADME (10^{-5} mbar) and the LINAC (10^{-9} mbar) has to be leak tight
- PADME needs again less multiple scattering and Bremsstrahlung
  - scrapering far away will not avoid asymmetric energy spread but is a cure for the off-track, drawback higher dose on window
- Ideal solution is a low thickness, metallic gating valve (permitting high and low intensity) before DHSTB001 (moment selector magnet) but not mech and vacuum feasible

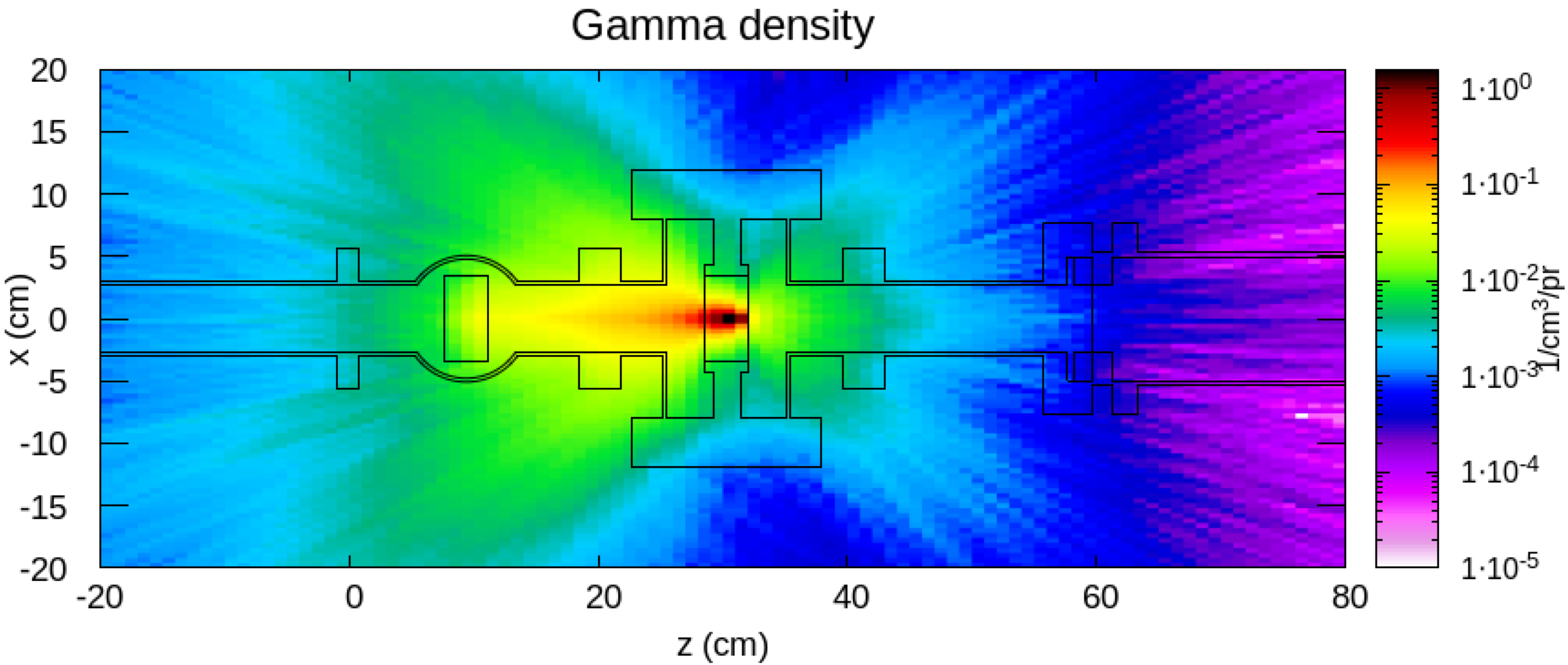


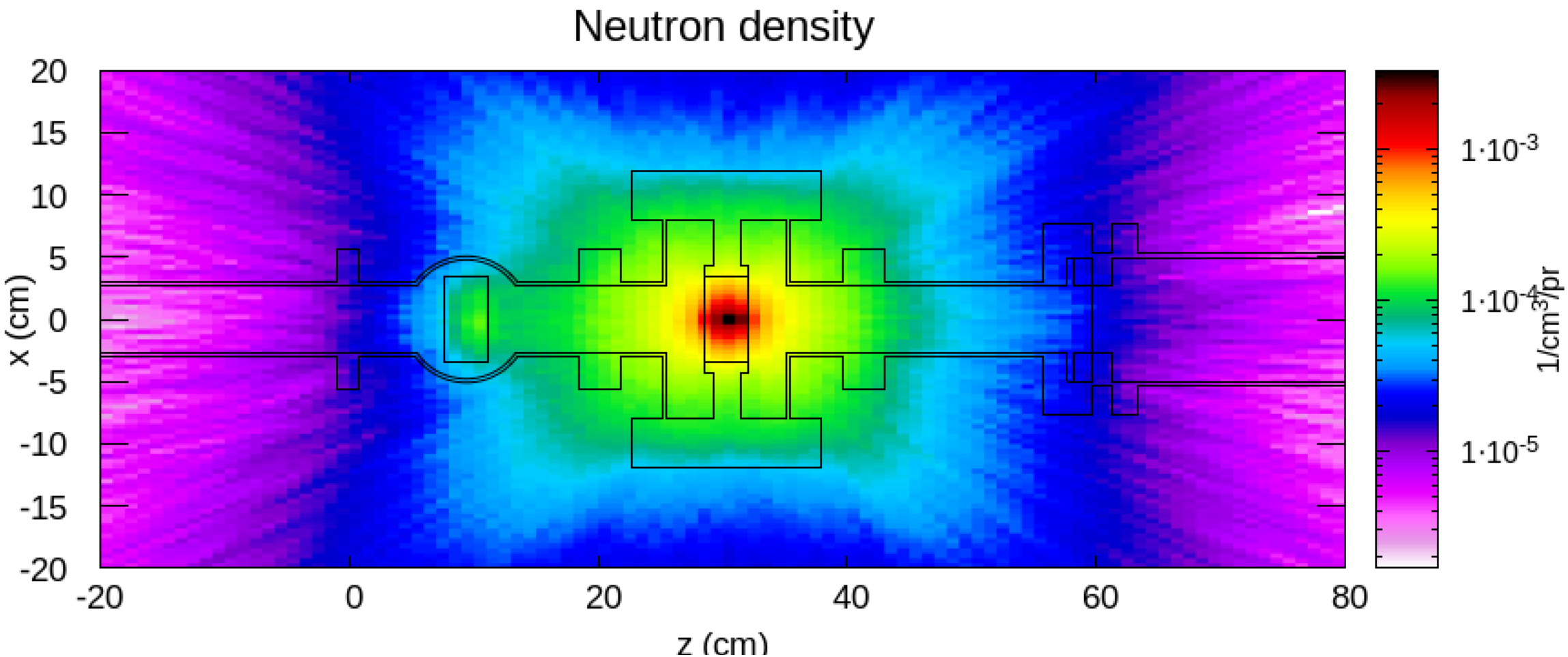


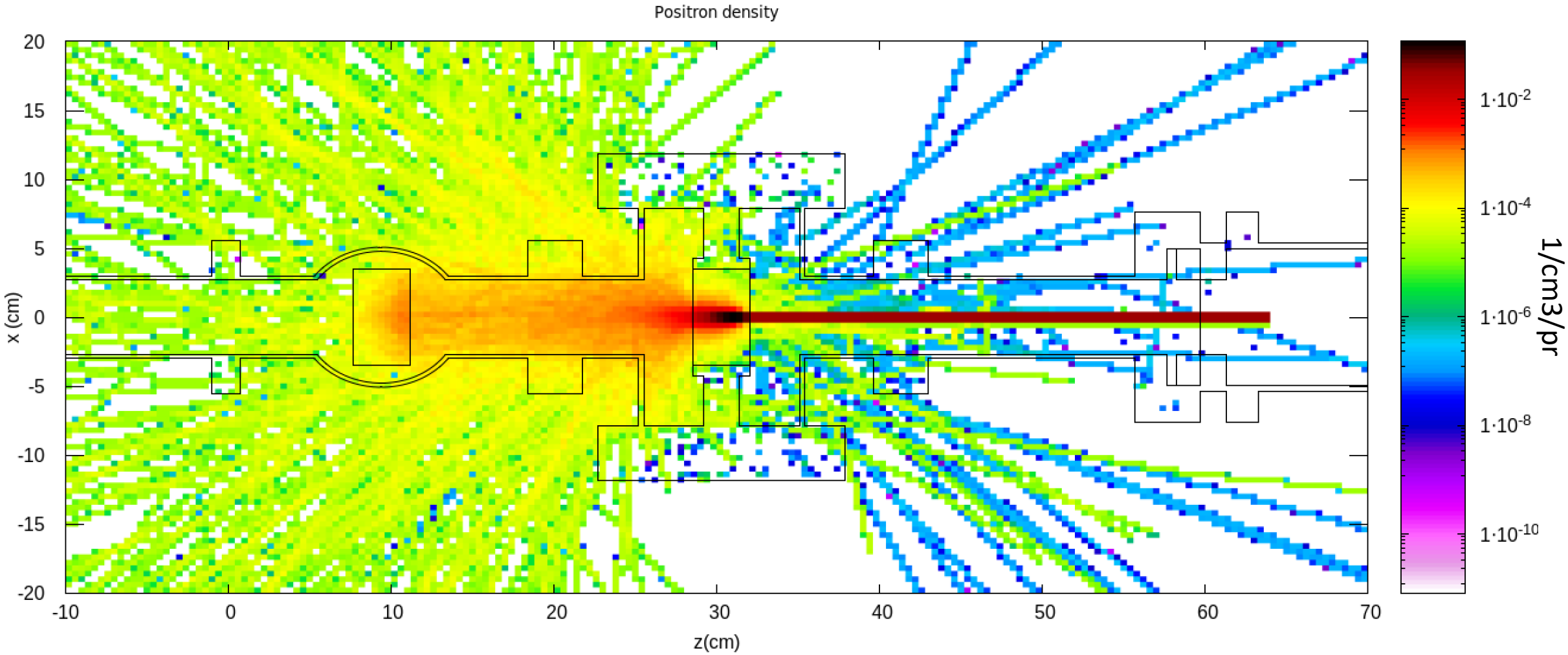
MYLAR DRAWBACKS → Is a polymer -> no rad tolerant -> frequent maintenance



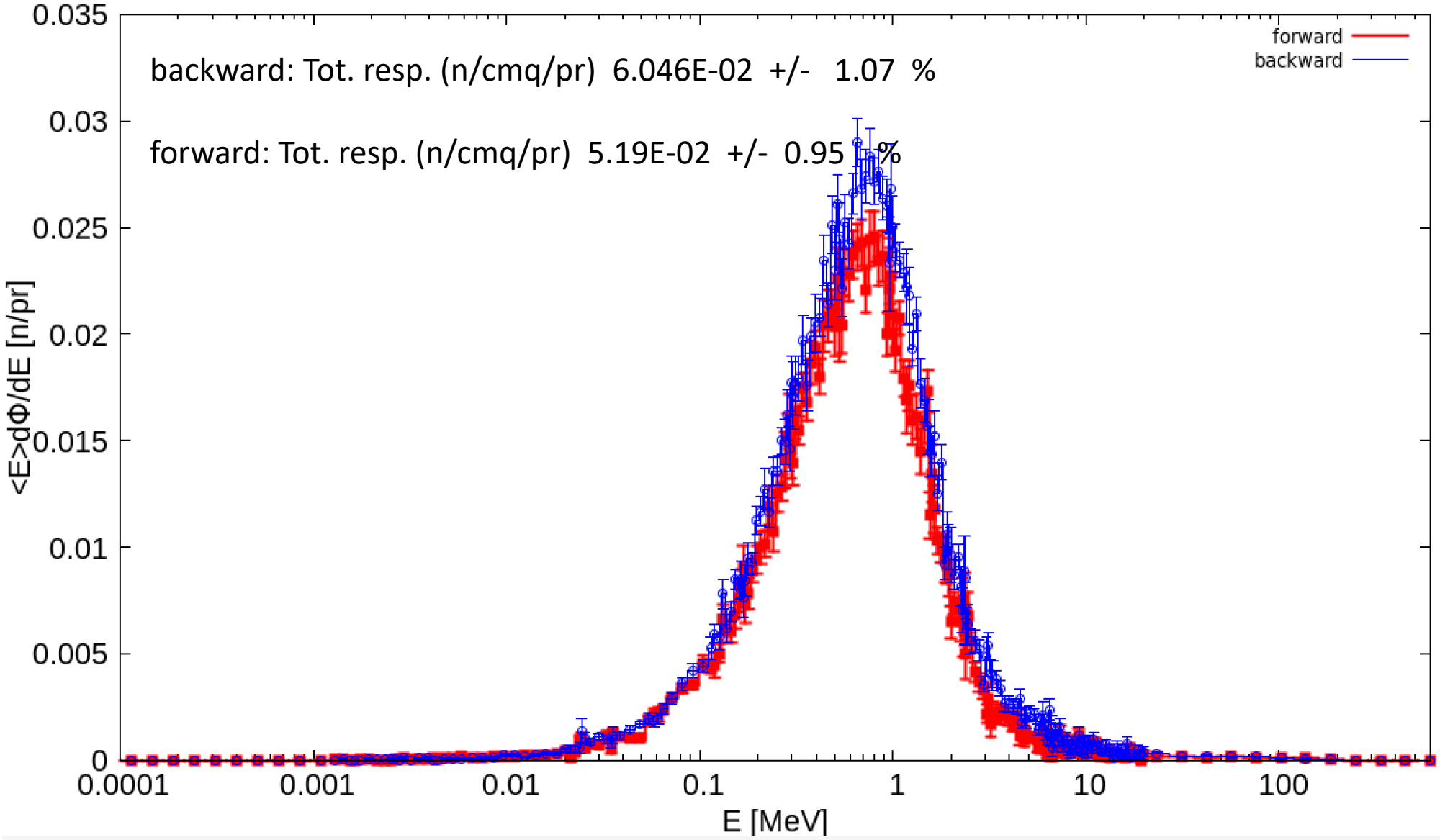
Results are per primary: multiply by the positron current to have real predictions (W/cm3)


Gamma density
20
15
10
5
0
-5
-10
-15
-20
x (cm)
-20
0
20
40
60
80
z (cm)
1·10^0
1·10^-1
1·10^-2
1·10^-3
1·10^-4
1·10^-5
1/cm^3/pr

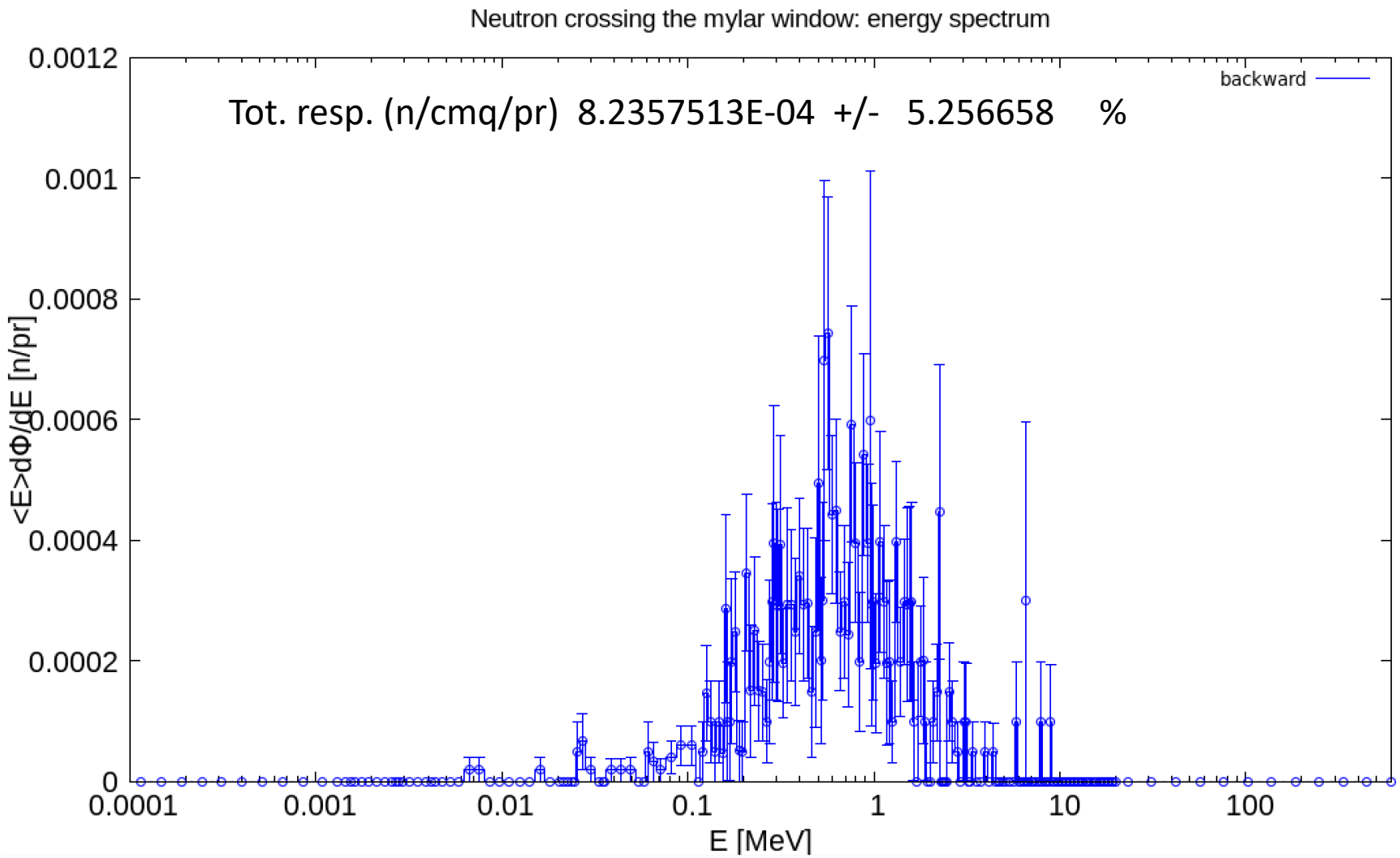

Neutron density
20
15
10
5
0
-5
-10
-15
-20
x (cm)
-20
0
20
40
60
80
z (cm)
1·10-3
1·10-4
1·10-5
1/cm3/pr


Positron density
x (cm)
z(cm)
1/cm3/pr
1·10-2
1·10-4
1·10-6
1·10-8
1·10-10

Neutrons escaping from scraper2: energy spectrum

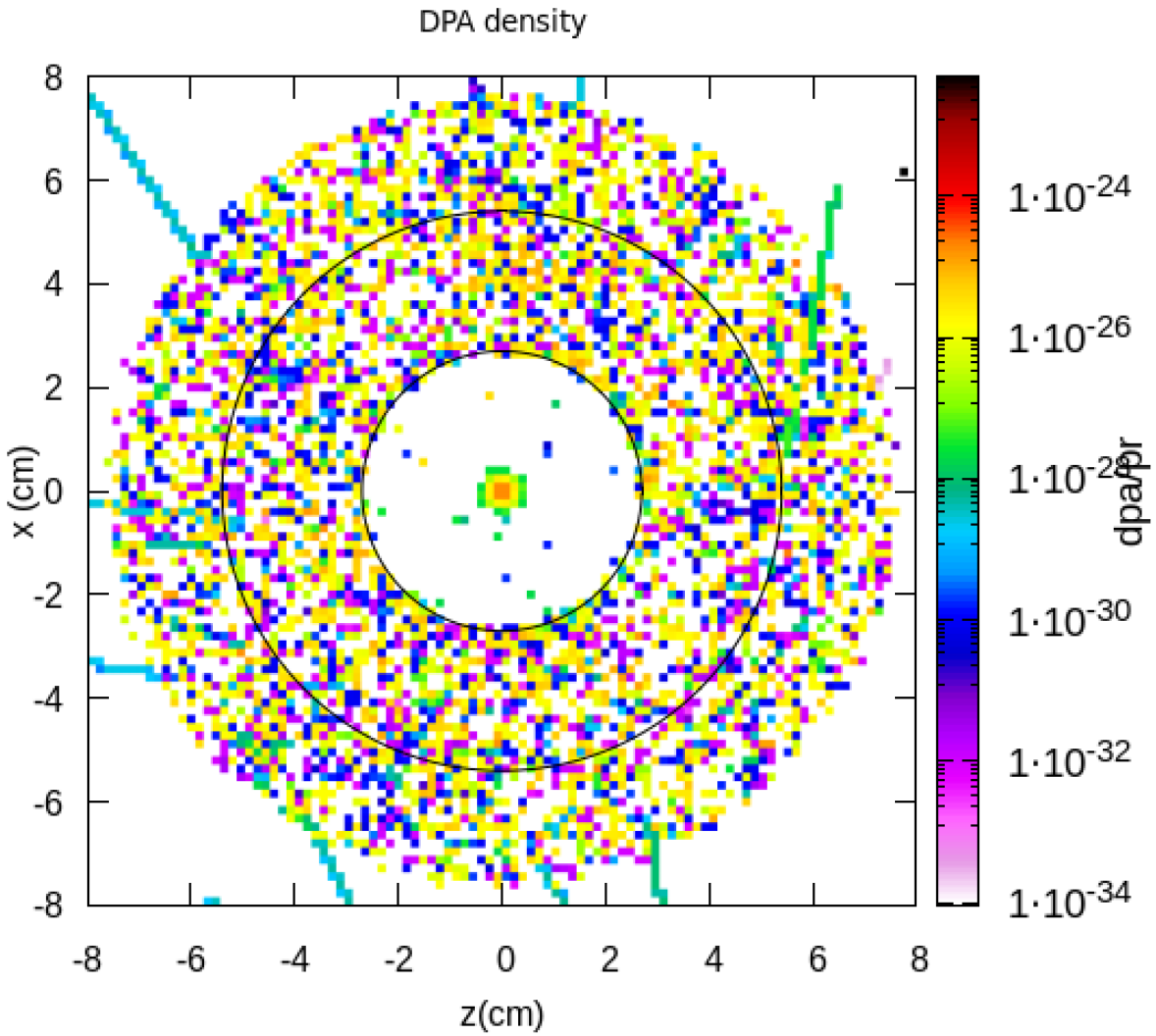


As expected neutrons photoproduced on W have energy around 0.7 MeV

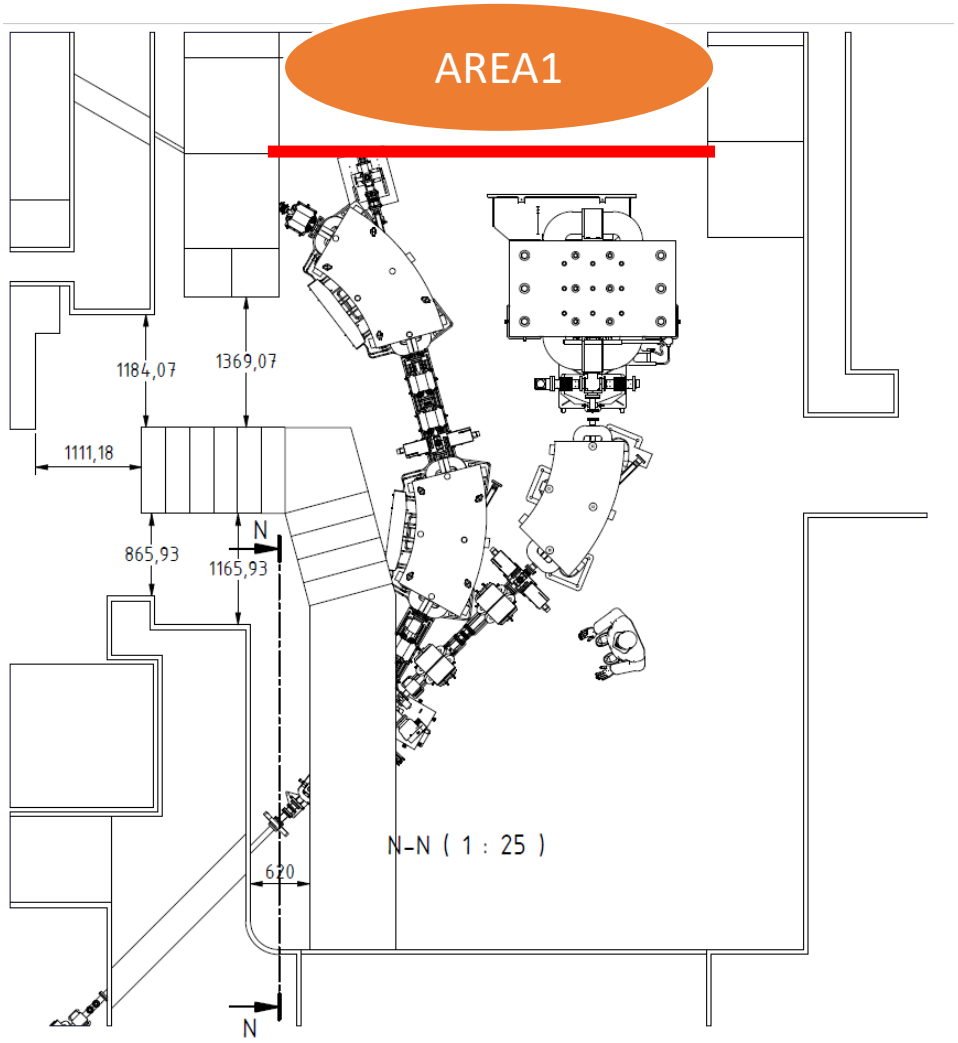


Neutrons impinging into the Mylar beam window

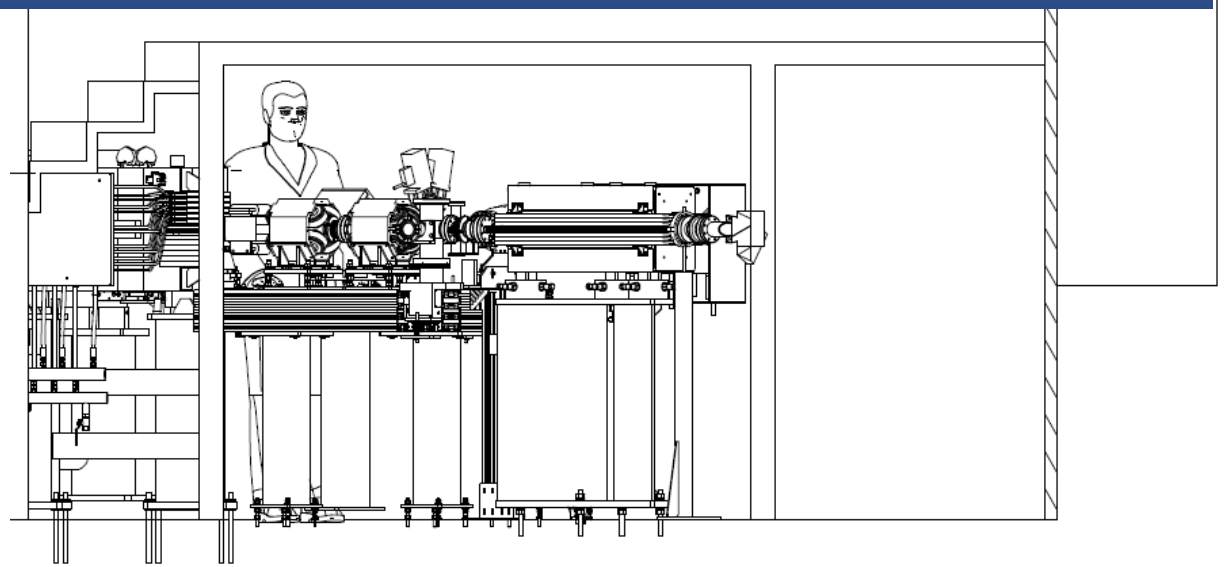
Preliminary results of “dpa” in the mylar beam window



Beam Line next – BTF2 Layout in BTFEH1

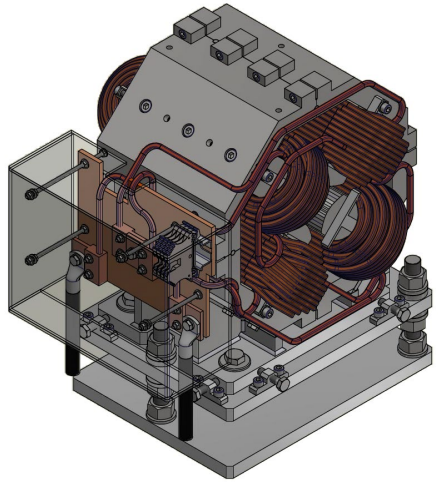


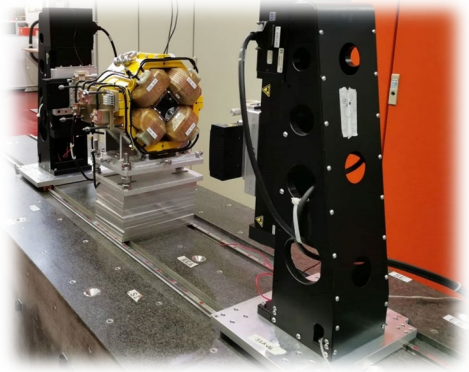
- Improved area rules when BTF2 installation will occur
- Needs a different site for racks
- Already moved the PADME cross services
- In the next future, PADME people only in AREA1
- There will be different search procedures

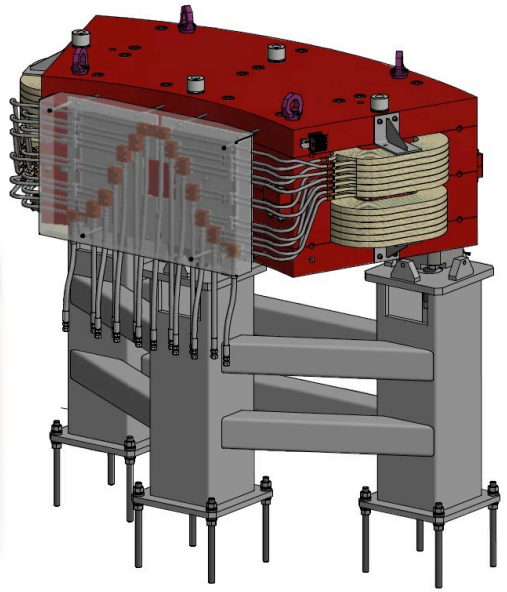


BTF DOUBLING LINE / MAGNETS

QUADS - H-dipoles





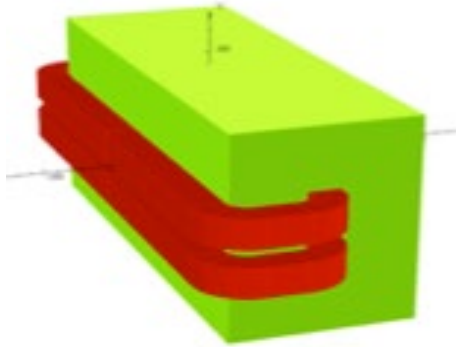


- In house design and assembly (Late 2017)
- Construction at SIGMAPHI
- Arrived @LNF in August
- Just measured with new measurement desk
- Magnets have good performances (little residual skew and octupolar components but in the required limits)
- Slightly better gradient then requested
- ~~Installation prob Autumn 2019~~ **Due to BeW breaking**

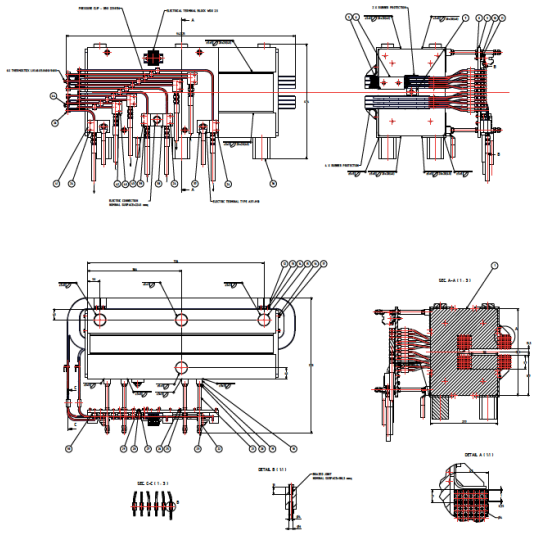
- H dipole - In house design and assembly (Late 2017)
- Construction at SIGMAPHI
- Delivering & characterization complete: March 2019
- Very good results in field measurements
- ~~Installation prob Autumn 2019~~ **Due to BeW breaking**

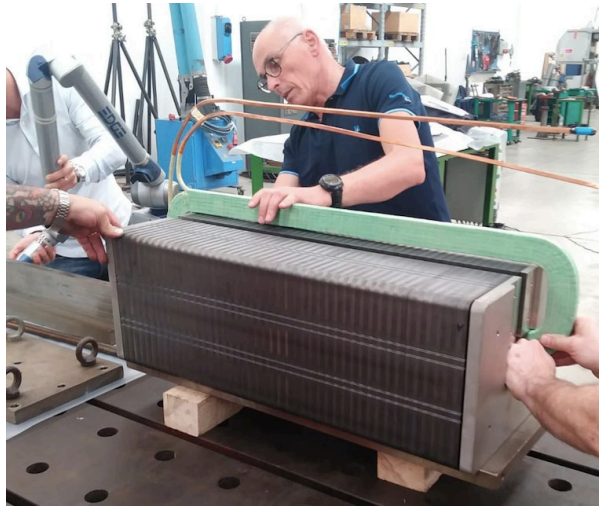
BTF DOUBLING LINE / MAGNETS

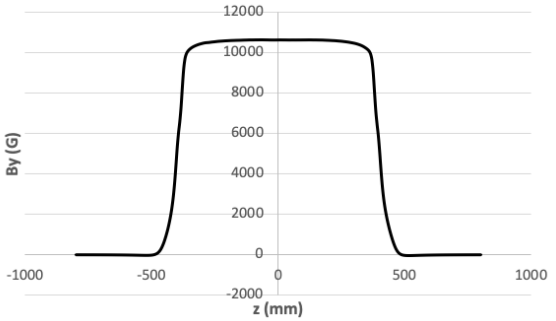
Fast C-dipole

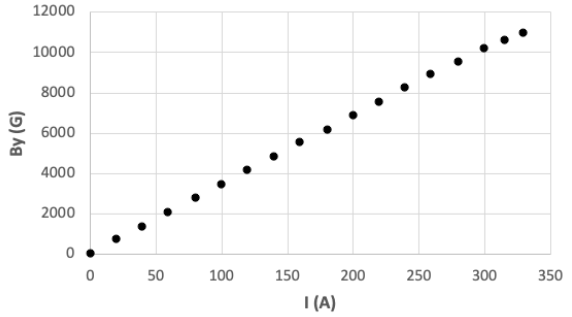


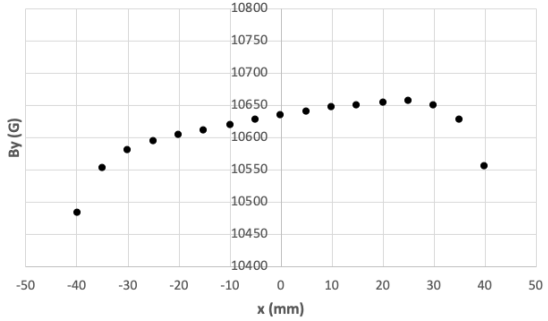
- Fast dipole - In house design (Late 2017)
- Construction at ORMET (Genova)
- Some issues on pole but seems ok
- Assembly in strong collaboration with LNF technicians
- Delivering, characterization and installation in June 2018
- Just used for BTF-2 beam commissioning and users







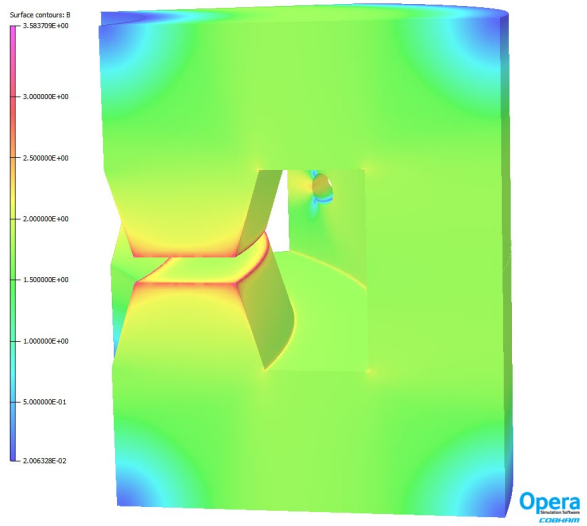


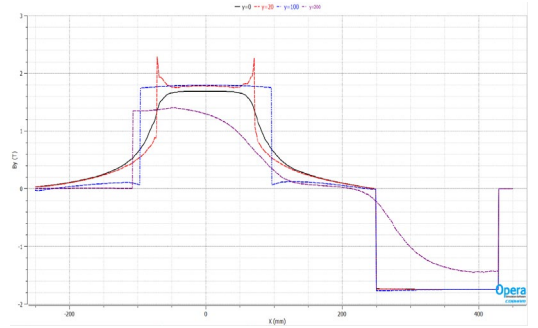


BTF DOUBLING LINE / MAGNETS

C-Dipole

- Design and Construction at DANFYSIK
- ABOUT to start the design
  - Uncertainity on the real date due to internal scheduling problem on this magnet
  - Actual delay one week
- DANFYSIK sets the commissioning in April 2020

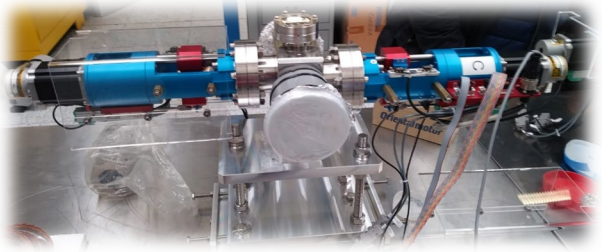




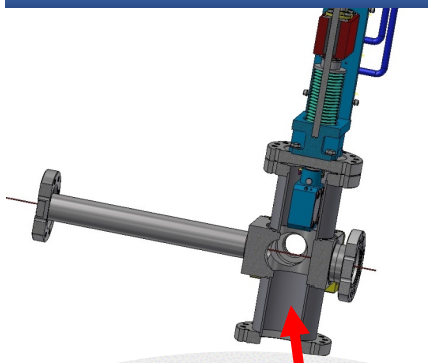
MAIN SPECIFICATIONS		
	Unit	**Value**
Beam Energy	MeV	920
Maximum Field	T	1,6878
Bending Radius	m	1,8
Magnet Lenght	mm	1108
Bending Angle	deg	35
Pole Iron Gap	mm	35
Integrated Field Quality		$1.3*10^{-3}$ over ±15mm
Number of turns per coil		104
Conductor dimensions	mm	9,5x9x5/ bore 5,5

Assigned on	**05-2019**
Conceptual design for LNF review:	15-11-2019 delayed
Final Design for LNF review:	27-11-2019 (just one week!)
Assembly of magnet complete at Danfysik:	13-03-2020
Tested magnet ready for shipment:	27-03-2020

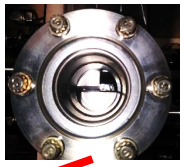
Scrapers, target, beam stopper and pipes

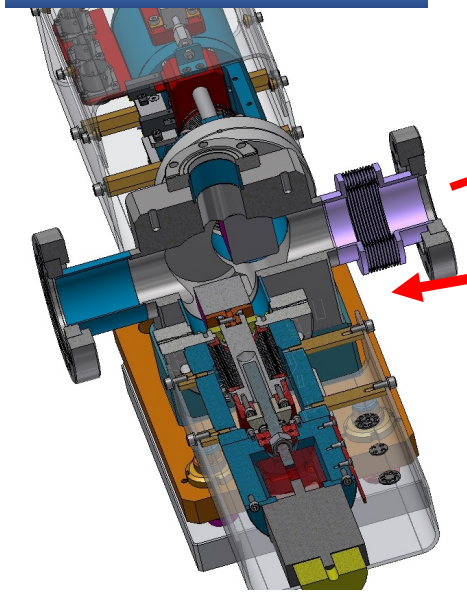


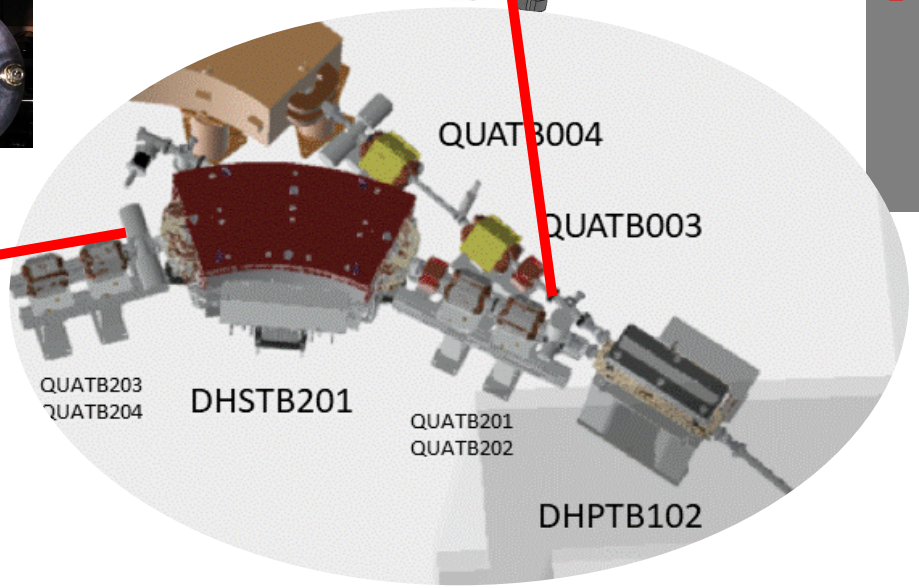
Beam stopper and target



Overlapped blade scrapers





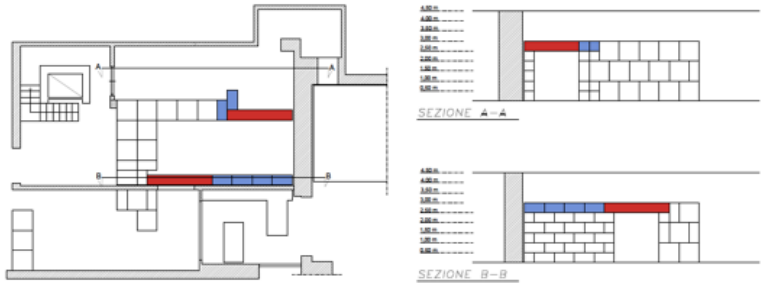


- In house new design of:
  - overlapped blade scraper (10um step)
  - two position, thin Cu target
  - thin walled pipes for DP(installed) and DC(working) magnets
- For the scrapers and target:
  - Electronics, controls, vacuum OK!
  - Ready to be installed – cabling to be completed shortly

BTF DOUBLING LINE / BTF-2 BUNKER

Mar. 2019

- Completely mapped with overall BTF+LINAC placing network
- Not totally complete, waiting the BTF2 magnets installation and cooling pipeline joints
- All of the remaining concrete blocks are ready
- Some bunker fire protection parts have to be completed



Last civil engineering for preparing external bunker structure (covers gap with LINAC tunnel external wall)